Model 2704

High performance Controller/programmer

User Guide

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INTRODUCTION

Thank you for selecting the 2704 high performance Programmer/Controller.

ABOUT THIS USER GUIDE

This User Guide describes installation and the **principle** of operation of the controller, and is intended as a 'Getting Started Guide'. It also includes the operation of a setpoint programmer and how to handle alarms.

For a detailed description of process specific features and how to configure these to a particular application, an Engineering handbook is also available, part no. HA026933. This may be ordered separately or downloaded from www.eurotherm.co.uk.

Because this controller can be supplied in different ways, it is important to note that the actual displays shown in this guide may not be identical to those shown on your particular controller.

Issue 6 of this User Guide includes features available in software versions up to and including 6.30.

Other related handbooks also available from the above web site are:

- iTools, Part no. HA028838. iTools is a PC based package designed to configure Eurotherm controllers.
- EMC Installation Guide Part no. HA025464.

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3 GETTING STARTED	This chapter describes the functions of the operator buttons, how to navigate to and change the value of parameters	6.0
4 PROGRAMMER OPERATION	This chapter describes the features of a setpoint programmer and how to set up and run programs using these features	5.0
5 ALARM OPERATION	This chapter explains the types of alarm used in this controller, how to set up and acknowledge alarms for a particular installation	3.0
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1. Chapter 1 OVERVIEW

Thank you for selecting the 2704 high performance Programmer/Controller.

1.1. WHAT IS 2704

The 2704 is a modular, fully configurable, high accuracy, high stability temperature and process controller available with single, dual or three loops.

It is supplied in accordance with an ordering code which can be found printed on a label on the side of the instrument case. This should be checked against the order code description given in Appendix A of this guide.

Alternatively, the controller can be supplied pre-configured for a specific application. Examples include:- Vacuum Furnace, Carbon Potential, Humidity, Boiler (TDS), Melt Pressure control. In these cases a process specific handbook is also included.

Figure 1-1: General View of 2704 Controller

Features include:

- A 120 x 160 pixel electroluminescent used to show all process information. The user interface is menu driven via the display and seven front panel keys.
- Advanced ramp/dwell programmer with storage of up to 60 programs.
- A wide variety of inputs which can be configured, including thermocouples, Pt100 resistance thermometers and high level process inputs.
- Each loop can be defined to be PID, On/Off or motorised valve position and can control using a variety of strategies including single, cascade, override and ratio control.
- PID control outputs can be relay, logic, triac or dc. Motorised valve position outputs can be relay, triac or logic.
- Auto tuning and PID gain scheduling are available to simplify commissioning and optimise the process

1.2. BEFORE YOU BEGIN

1.2.1. Unpacking

The packaging is designed to withstand reasonable transit shocks. It is suggested that each item is unpacked carefully and the contents inspected for damage.

If there is evidence of shipping damage, please notify your supplier within 72 hours. The packaging should be retained for inspection.

All packaging contains anti-static materials to prevent the build up of static which can damage electronic assemblies.

1.2.2. Contents of Packaging

Each box contains the following parts:-

1. The 2704 controller fitted into its corresponding sleeve. Labels on the sleeve identify the controller code, its serial number, and the customer reference number.
2. Two panel retaining clips
3. Burden resistors for use with mA inputs
4. This User Guide

Please refer to Figure 1-2 showing a general view of the controller.

1.2.3. Does the Controller Match the Process?

Every controller is supplied with a specific hardware configuration to match the process which it is designed to control. For example, there are five 'slots' which can contain different plug in modules. These are defined by a hardware code as shown in Appendix A.

Where possible the controller is supplied with its software configured to match the process. This is defined by the configuration coding also given in Appendix A.

Before installing the 2704 controller check both the hardware code and configuration code to ensure that it is suitable for your process.

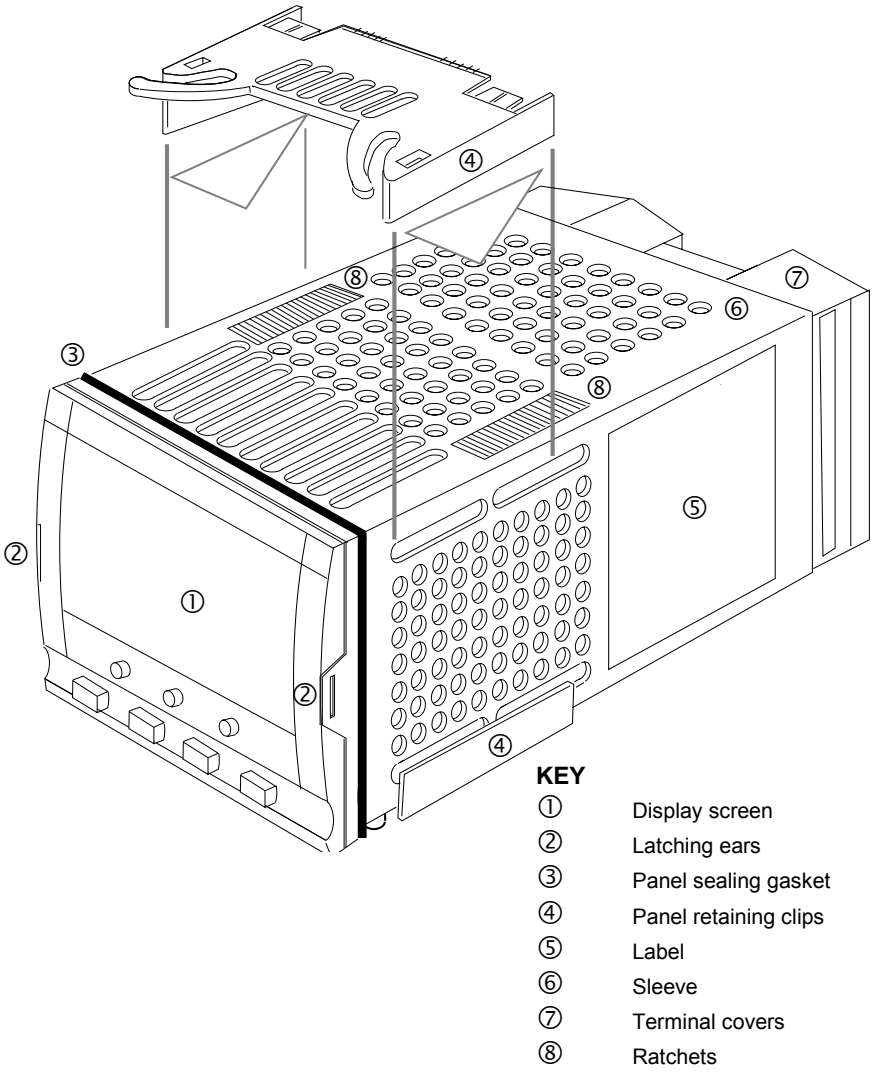
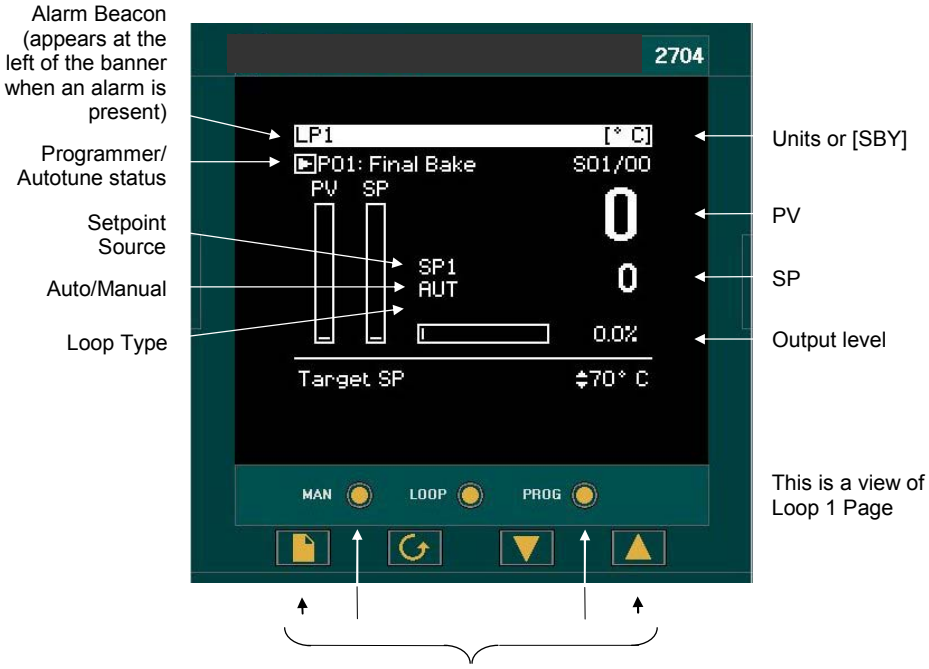


Figure 1-2: General View of 2704 Controller

1.3. OPERATOR INTERFACE - OVERVIEW

The front panel of the 2704 consists of a 120 x 160 pixel electroluminscent display, and seven operator push-buttons. See Figure 1-3.

- The display is used to show the process conditions.
- The seven operator buttons allow adjustments to be made to the controller.



These are described in more detail in Chapter 3

	Page button	Press to select a new list of parameters.
	Scroll button	Press to select a new parameter in a list.
	Down button	Press to decrease a parameter value.
	Up button	Press to increase a parameter value.

Figure 1-3: Operator Interface

1.3.1. Status Messages

Messages appear on the display to show the current status of the controller. Table 1-1 below describes these messages:-

LP1, LP2, LP3	Indicates which loop is being viewed
AUT	The selected loop is in automatic (closed loop) control
MAN	The selected loop is in manual (open loop) control
SP1, SP2, PO1 to P50, REM	Indicates where the SP is derived, i.e. Setpoint 1, Setpoint 2, Programmer, Remote
CSD	Indicates that the loop is in cascade.
OVR	Indicates that the loop is in override.
RAT	Indicates that the loop is in ratio (Ratio must be enabled from the parameter list at the bottom of the display)
	Indicates a program is activated
	Indicates a program is held at its current levels
	Indicates a program is in reset condition i.e. not running
	When an alarm occurs an alarm symbol flashes in the header banner. When the alarm is acknowledged but is still active the symbol will be permanently lit. When the alarm is acknowledged but is no longer active the symbol will disappear. See Chapter 5 'Alarm Operation' for further details.
[UNITS]	The process units are displayed in the right hand side of the banner
[SBY]	This symbol will flash in the right hand side of the banner in place of 'units' when the controller is in standby mode. In this state all interfaces to the plant are switched to a rest condition. For example, all control outputs = 0. **When this symbol is on the controller is no longer controlling the process.** This symbol will be on when:- • The controller is in configuration mode • Standby mode has been selected through the user interface or via an external digital input • During the first few seconds after start up

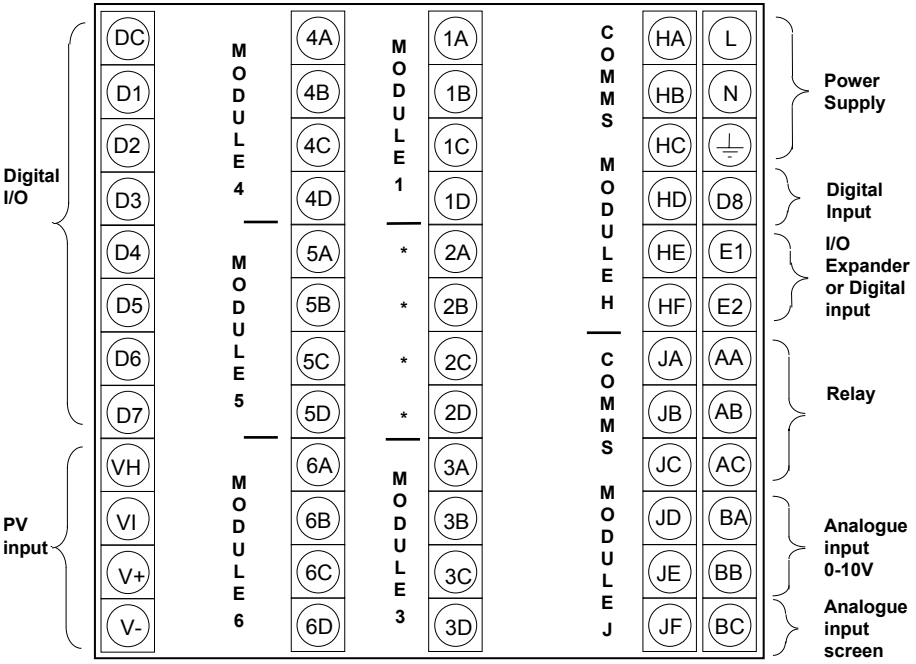
Table 1-1: Status Messages

1.4. INSTALLATION - OVERVIEW

The 2704 controller must be mounted and wired in accordance with the instructions given in Chapter 2.

The controller is intended to be mounted through a cut out in the front panel of an electrical control cabinet. It is retained in position using the panel mounting clips supplied.

All wires are connected to terminals at the rear of the instrument. Each block of six terminals is protected by a hinged cover which clicks into closed position.



The functionality of the two outer rows of terminals is common to all instrument variants, as follows:-

PV input	VH, VI, V+, V-
Analogue input	BA, BB
I/O expander	E1, E2
Fixed changeover relay	AA, AB, AC
Digital I/O channels	D1 to D8 and DC
Power supply	L, N, Earth

*** Terminals 2A, 2B, 2C, 2D must not be wired to.**

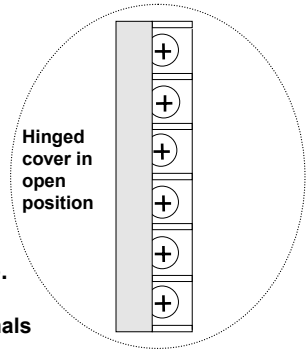


Figure 1-4: Rear Terminals

1.5. I/O MODULES

The 2704 controller has the facility to fit optional plug in modules. The connections for these modules are made to the inner three connector blocks as shown in Figure 1-4
The modules are:

- Communications modules See also section 2.4
- I/O modules See also section 2.4

These modules are fitted simply by sliding them into the relevant position as shown in Figure 1-5.

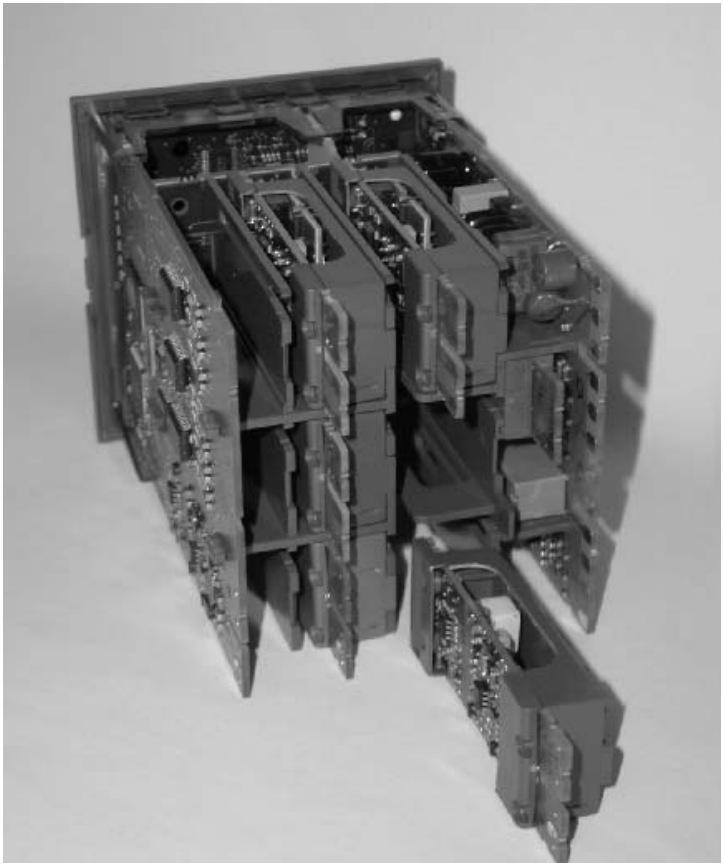


Figure 1-5: View of the Plug-in Modules

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2. Chapter 2 INSTALLATION

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2.1. MECHANICAL INSTALLATION

2.1.1. Positioning

The controller can be mounted vertically or on a sloping panel of maximum thickness 15mm (0.6in). Adequate access space must be available at the rear of the instrument panel for wiring and servicing purposes. The outline dimensions are shown in figure 2-1.
Take care not to cover ventilation holes in the top, bottom and sides of the instrument.

Before proceeding please read Appendix B 'Safety and EMC Information'.

2.1.2. Outline dimensions Model 2704

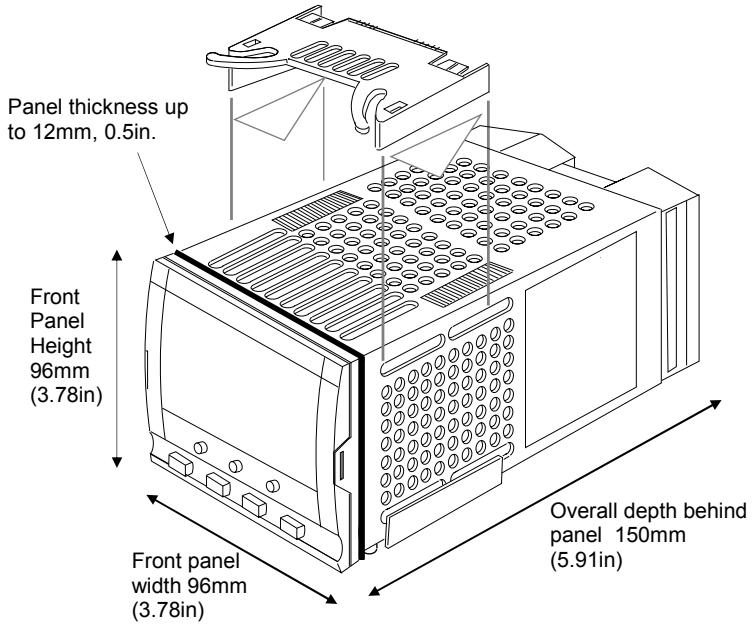

Panel thickness up to 12mm, 0.5in.
Front Panel Height 96mm (3.78in)
Front panel width 96mm (3.78in)
Overall depth behind panel 150mm (5.91in)

Figure 2-1: Outline Dimensions

2.1.3. Mounting the Controller

1. Prepare the panel cut-out to the size shown in Figure 2-2. Ensure that there is sufficient spacing between instruments as shown by the minimum dimensions given in Figure 2-2. Ensure also that the controller is not mounted close to any device which is likely to produce a significant amount of heat which may affect the performance of the controller.
2. Insert the controller through the panel cut-out.
3. Spring the upper and lower panel retaining clips into place. Secure the controller in position by holding it level and pushing both retaining clips forward.

Note:- If the retaining clips subsequently need removing, in order to extract the controller from the control panel, they can be unhooked from the side with either your fingers or a screwdriver.

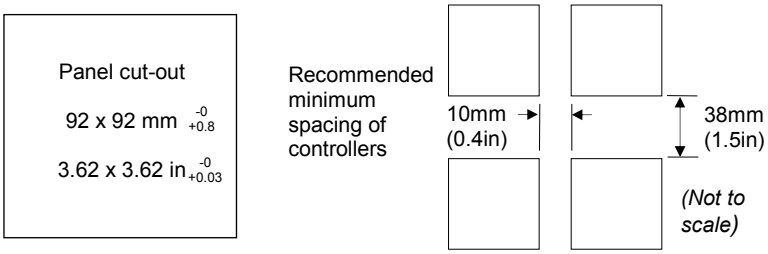


Figure 2-2: Panel Cut-out and Minimum Spacing Requirements

2.1.4. Unplugging and Plugging in the Controller

If required, the controller can be unplugged from its sleeve by easing the latching ears outwards and pulling the controller forward out of the sleeve. When plugging the controller back into its sleeve, ensure that the latching ears click into place.

It is recommended that the power to the controller is switched off when un-plugging or plugging the controller into its sleeve. This is to prevent premature wear on the controller connectors when current is flowing through them.

2.2. WIRING

WARNING

You must ensure that the controller is correctly configured for your application. Incorrect configuration could result in damage to the process being controlled, and/or personal injury. It is your responsibility, as the installer, to ensure that the configuration is correct. The controller may either have been configured when ordered, or may need configuring now. See 2704 Engineering Manual Part Number HA026933 for details.

Before proceeding further, please read Appendix B, Safety and EMC information.

2.2.1. Electrical Connections

All electrical connections are made to the screw terminals at the rear of the controller. They accept wire sizes from 0.5 to 1.5 mm^2 (16 to 22 AWG) and should be tightened to a torque of 0.4Nm (3.5lbin). If you wish to use crimp connectors, the correct size is AMP part number 349262-1. The terminals are protected by a clear plastic hinged cover to prevent hands, or metal, making accidental contact with live wires.

2.2.2. Rear Terminal Layout

The rear terminal layout is shown in Figure 2-3, which identifies terminal designations and their functions. Refer to the individual diagrams to wire the controller to your requirements.

The two outer terminal strips have fixed hardware for all versions of the instrument, as follows:-

- A Process Variable input which can be configured for:-
    - Thermocouple, RTD, Pyrometer, Voltage (e.g. 0-10Vdc) or Milliamp (e.g. 4-20mA) plus vacuum – log10
- Seven Digital I/O, configurable as input or output
    - Inputs are logic (-1 to 35Vdc) or contact closure, and can be configured for:- Manual, Remote, Run, Hold, Reset, etc,
    - Outputs are open collector requiring an external power supply, and can be configured as event, status time proportioning or valve position outputs.
- One digital input
- An I/O expander which allows additional digital I/O via an external unit, or an extra digital input
- A changeover relay which can be configured as an alarm or event output. It cannot be configured as a time proportioning output
- An analogue input for volts (e.g. 0-10Vdc) or Milliamp (e.g. 4-20mA) signals to a second PID loop, setpoint, etc,. (This input can be characterised to match a particular curve from a transmitter. It cannot accept thermocouple inputs directly)
- Power supply to the unit. The supply may be 85 - 264Vac 50 or 60 Hz,

The three central terminal strips are for optional plug in modules, as follows:-

- Terminals marked 2A to 2D are reserved for a Memory Module only. No connections should be made to these terminals
- Terminals marked HA to HF are connections for optional RS232, RS485, or RS422 communications modules
- Terminals marked JA to JF are connections for an optional slave communications module or second communications port used to communicate with other instruments
  The modules fitted into the above two communications slots can be inter-changed

For a full list of available modules refer to the Ordering code - Appendix A and the Technical Specification - Appendix C.

Warning:- Take care that mains supplies are connected only to the power supply terminals (85 to 254Vac only), the fixed relay terminals or to relay or triac modules. Under no circumstances should mains supplies be connected to any other terminals.

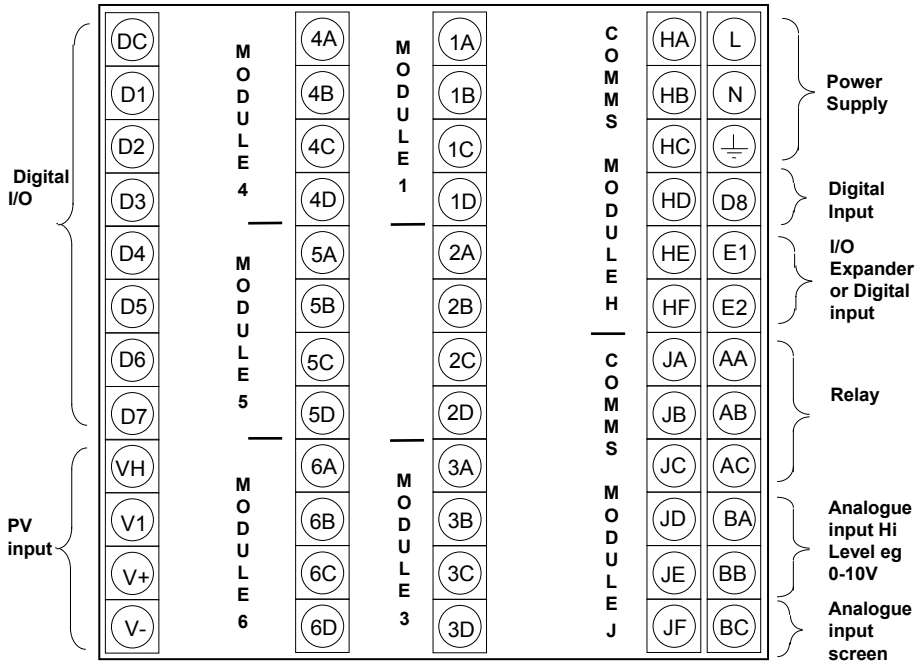


Figure 2-3: Rear Terminal Connections

2.3. STANDARD CONNECTIONS

2.3.1. Power Supply Wiring

Controllers supplied with the VH Supply Voltage option are suitable for connection to a power supply of between 85 and 264Vac 50 or 60 Hz.

Controllers supplied with the VL Supply Voltage option are suitable for connection to a power supply of between 20 and 29Vac 50 or 60 Hz or 20 to 29Vdc.

It is the users responsibility to provide an external fuse or circuit breaker. Suitable fuses are :-
85 to 264 volt supply T type (EN60127 time-lag type) rated at 1A
20 to 29 volt supply T type (EN60127 time-lag type) rated at 4A

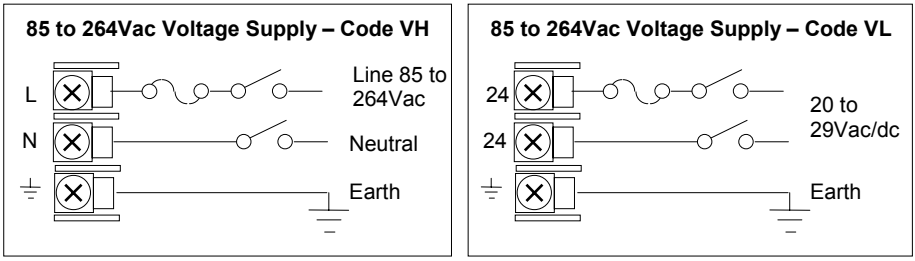


Figure 2-4: Supply Voltage Connections

2.3.2. Relay Output

A single changeover relay is provided as standard. It can be configured as a control output or an alarm or event output.

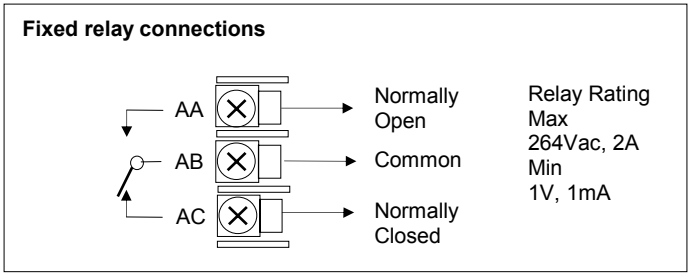
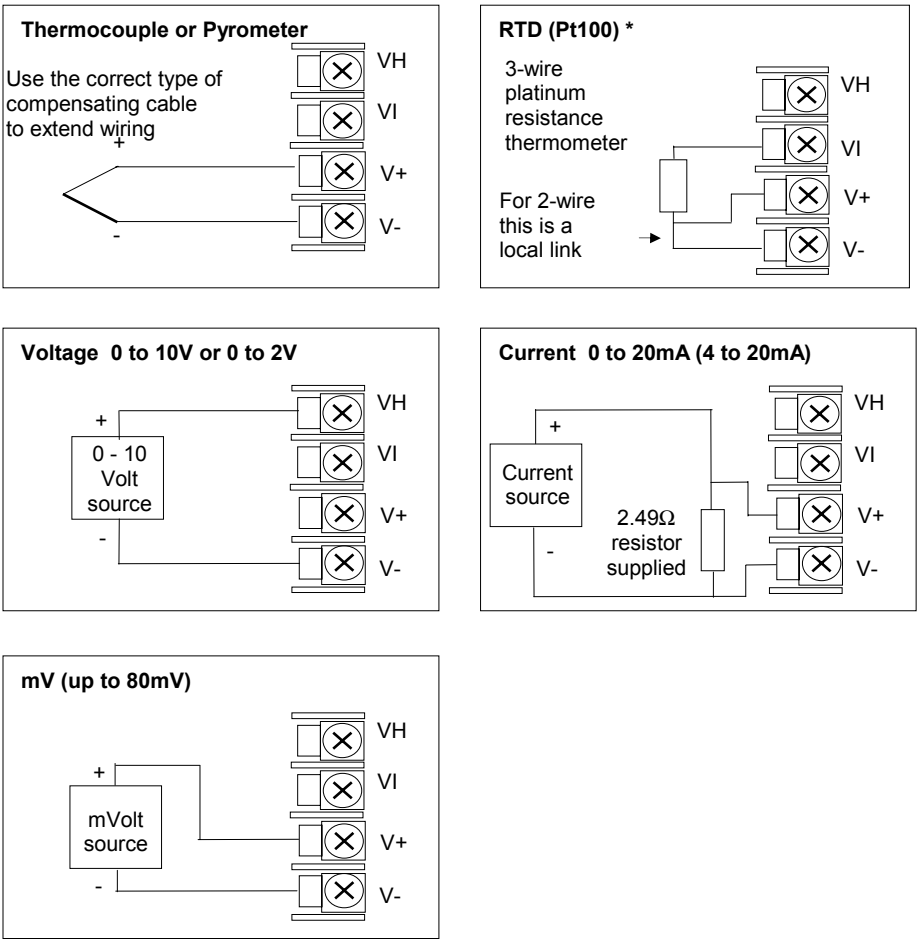


Figure 2-5: Wiring Connections For Fixed Relay Output

2.3.3. Sensor Input Connections

The fixed PV input can accept a range of sensors including Thermocouple, RTD (Pt100), Pyrometer, Voltage (e.g. 0-10Vdc) or Milliamp (e.g. 4-20mA) signals. These sensors are used to provide inputs to Control Loop 1.



* Note: This connection is shown for 26 and 2700 series controllers. It is not the same as 2400 and 2200 series controllers.

Figure 2-6: Wiring Connections For PV Input

2.3.4. Analogue Input Connections

The analogue input is supplied as standard and is intended to accept 0 to 10 Vdc from a voltage source. A milli-amp current source can be used by connecting a 100Ω resistor across terminals BA and BB. This input can be used as a remote setpoint input, remote setpoint trim or as a high level PV input to a control loop. This input is not isolated from the digital IO.

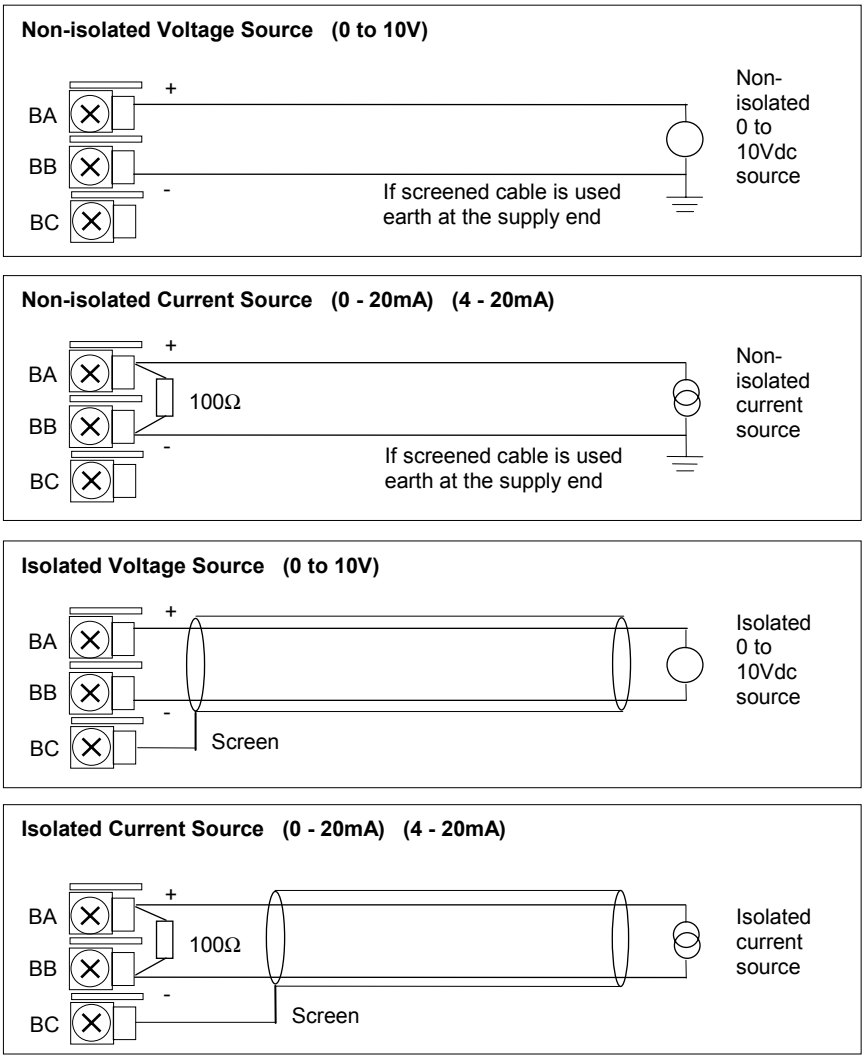

Non-isolated Voltage Source (0 to 10V)
BA
BB
BC
+
-
Non-isolated 0 to 10Vdc source
If screened cable is used earth at the supply end
Non-isolated Current Source (0 - 20mA) (4 - 20mA)
100Ω
Non-isolated current source
If screened cable is used earth at the supply end
Isolated Voltage Source (0 to 10V)
Isolated 0 to 10Vdc source
Screen
Isolated Current Source (0 - 20mA) (4 - 20mA)
Isolated current source
Screen

Figure 2-7: Wiring Connections For Analogue Input

2.3.5. I/O Expander (or Additional Digital Input)

An I/O expander (Model No 2000IO) can be used with the 2704 to allow the number of I/O points to be increased by a further 20 digital inputs and 20 digital outputs. Data transfer is performed serially via a two wire interface from instrument to expander.
If the expander unit is not required it is possible to use terminals E1 & E2 as a secondary digital input. These terminals are not part of the digital I/O terminals D1 to D8 and if used in this way connect a 2K2, ¼ W limiting resistor in series with the input, see Figure 2-8.

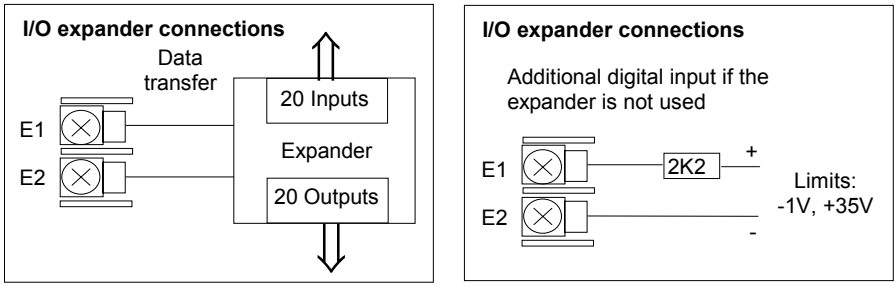


Figure 2-8: Wiring Connections for the I/O Expander

For details of the IO Expander refer to the Operating Instructions HA026893. The connections for this unit are reproduced below for convenience.

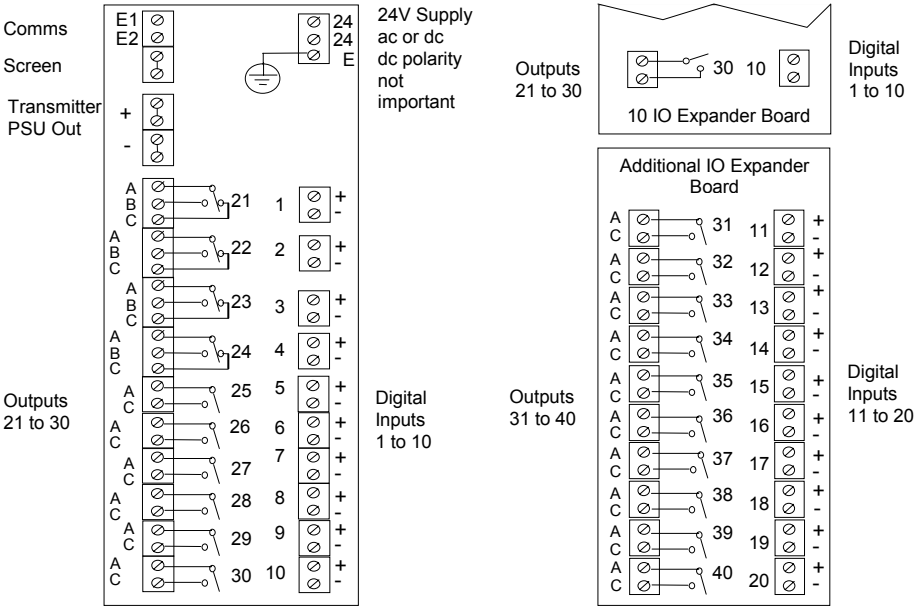


Figure 2-9: IO Expander Connections

2.3.6. Digital I/O

Eight digital I/O connections are provided as standard. They can be individually configured as:

1. Inputs Run, Hold, Reset, Auto/Manual, etc, - logic or contact closure.
2. Outputs Configurable as Control outputs, Programmer Events, Alarms, etc.

Digital IO is not isolated from instrument ground.

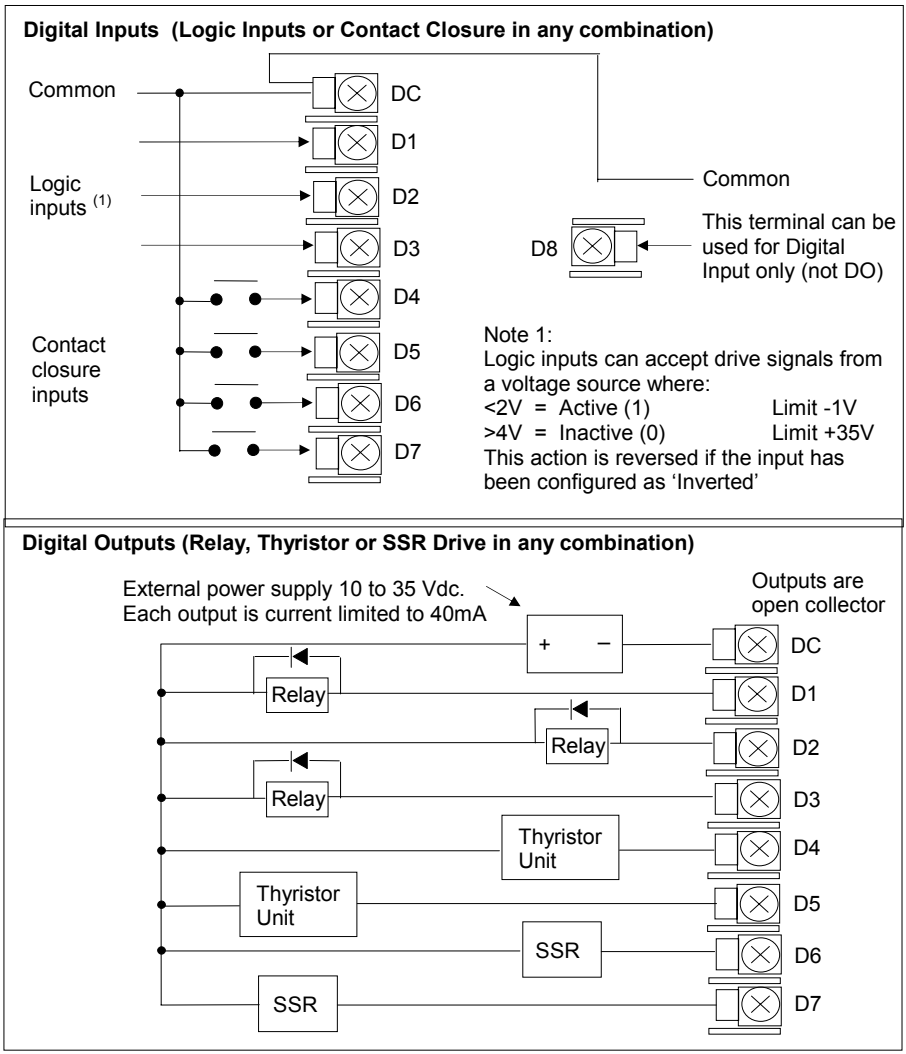


Figure 2-10: Wiring Connections for Digital I/O

2.4. OPTIONAL PLUG IN MODULE CONNECTIONS

2.4.1. Digital Communications Connections

Digital Communications modules can be fitted in two positions in the 2704 controller. The connections being available on HA to HF and JA to JF depending on the position in which the module is fitted. The two positions could be used, for example, to communicate with a configuration package, such as 'iTools', on one position and to a PC running a supervisory package on the second position.

The connections shown in the following diagrams show RS232, 2-wire RS485, 4-wire RS422 and master/slave comms to a second controller.

The diagrams show connections for 'bench top test' wiring. For a full description of the installation of a communications link, including line resistors, see Communications Handbook, Part No. HA026230, and EMC Installation Guide, part no. HA025464.

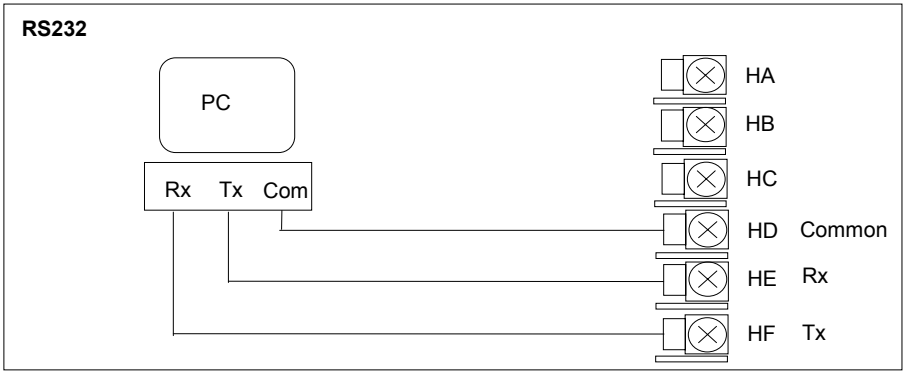


Figure 2-11: RS232 Communications Connections

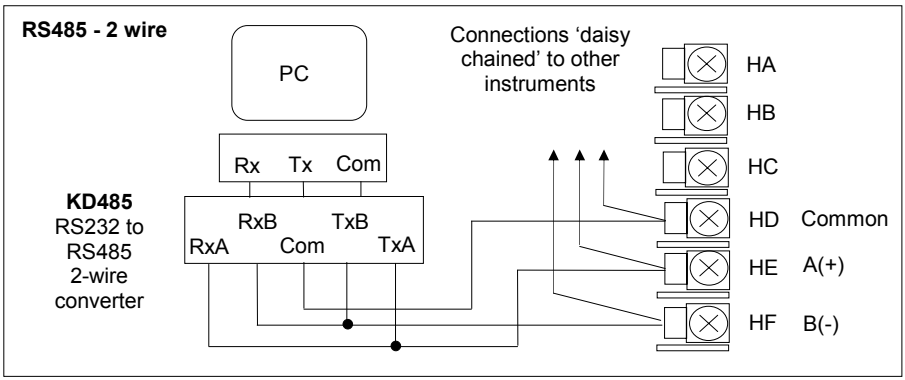


Figure 2-12: RS485 2- Wire Communications Connections

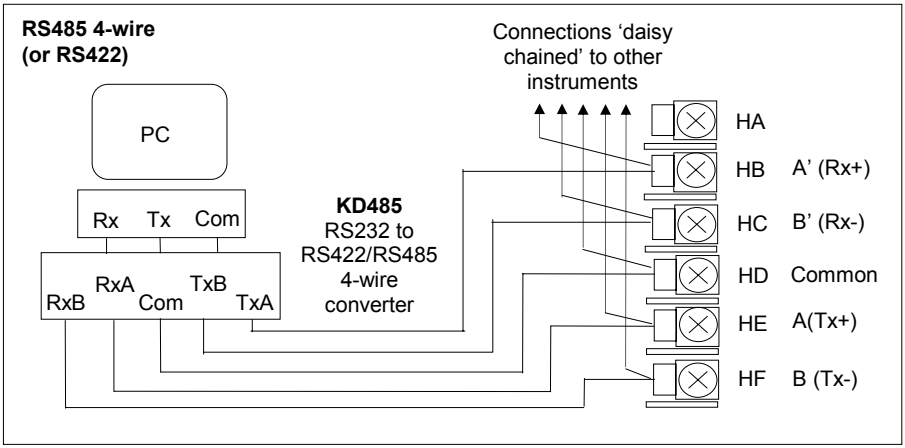


Figure 2-13: RS485 4-Wire Communications Connections

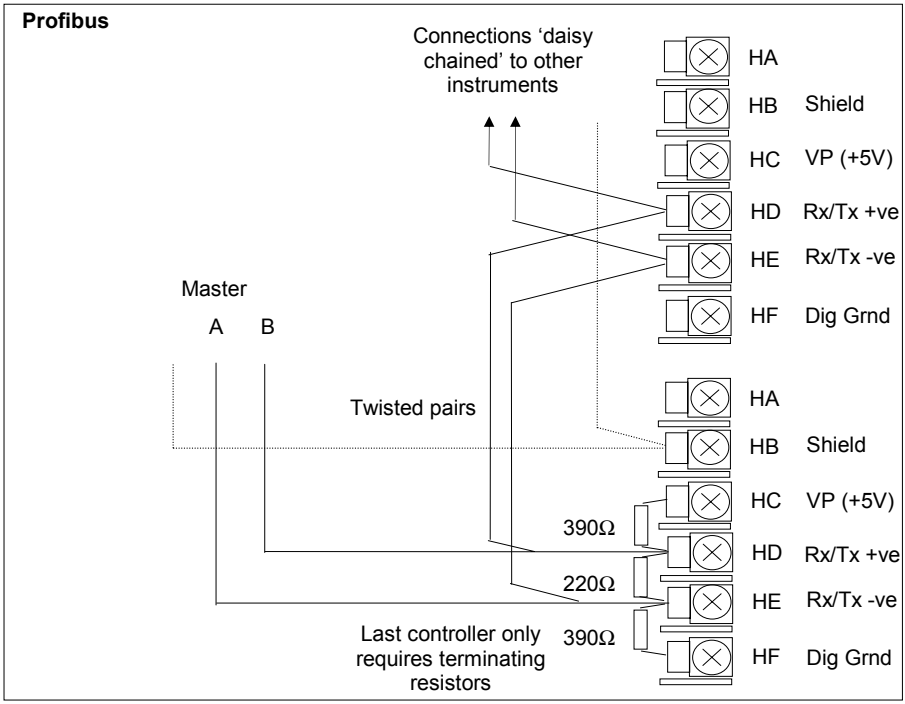


Figure 2-14: Profibus Wiring Connections

2.4.2. Devicenet Wiring

This section covers the DeviceNet digital communications option. To configure DeviceNet communications refer to the 2704 Engineering Handbook Part No HA026933.

2.4.2.1. DeviceNet Terminal Functions

Terminal Reference	CAN Label	Color Chip	Description
HA	V+	Red	DeviceNet network power positive terminal. Connect the red wire of the DeviceNet cable here. If the DeviceNet network does not supply the power, connect to the positive terminal of an external 11-25 Vdc power supply.
HB	CAN_H	White	DeviceNet CAN_H data bus terminal. Connect the white wire of the DeviceNet cable here.
HC	SHIELD	None	Shield/Drain wire connection. Connect the DeviceNet cable shield here. To prevent ground loops, the DeviceNet network should be grounded in only one location.
HD	CAN_L	Blue	DeviceNet CAN_L data bus terminal. Connect the blue wire of the DeviceNet cable here.
HE	V-	Black	DeviceNet network power negative terminal. Connect the black wire of the DeviceNet cable here. If the DeviceNet network does not supply the power, connect to the negative terminal of an external 11-25 Vdc power supply.
HF			Connect to instrument earth

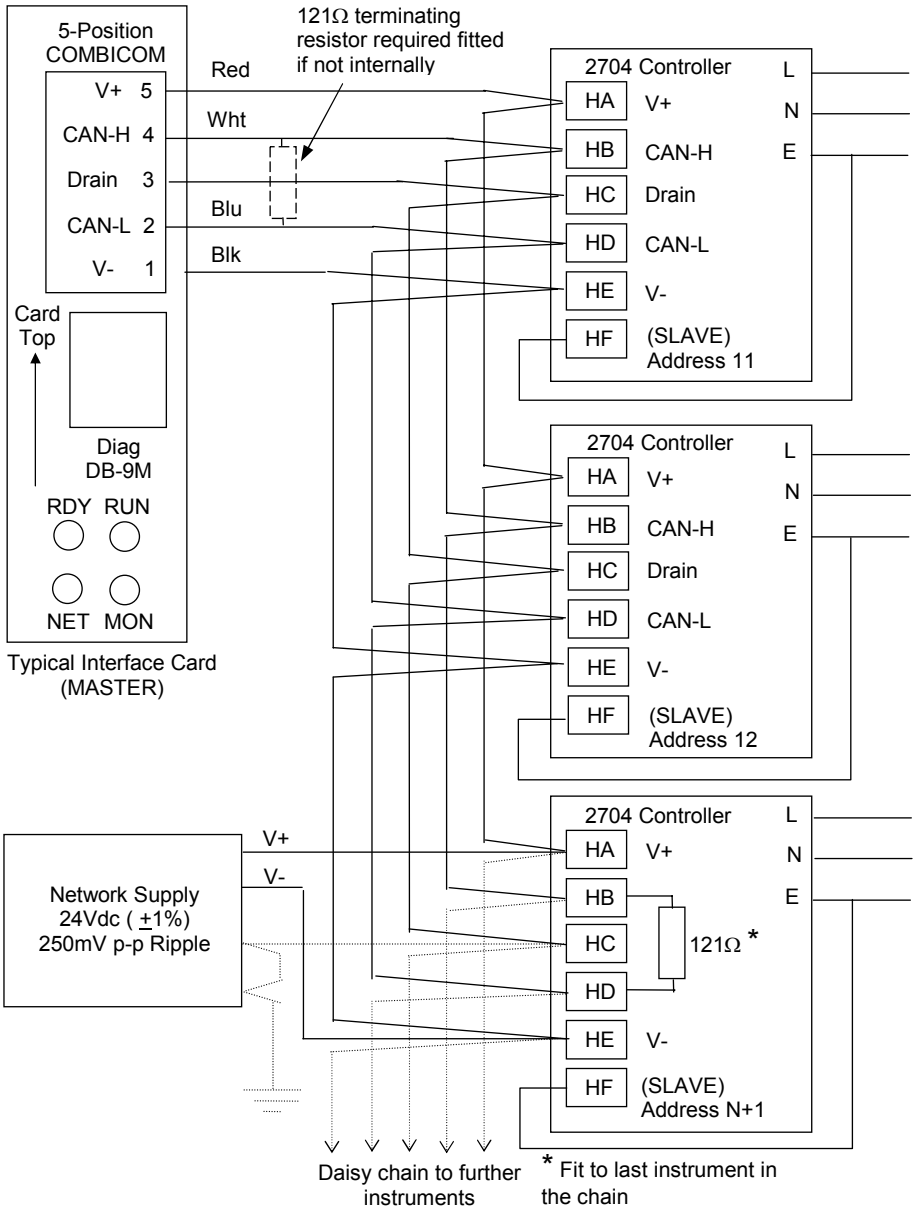
Note: Power taps are recommended to connect the DC power supply to the DeviceNet trunk line. Power taps include:

A Schottky Diode to connect the power supply V+ and allows for multiple power supplies to be connected.

2 fuses or circuit breakers to protect the bus from excessive current which could damage the cable and connectors.

The earth connection, HF, to be connected to the main supply earth terminal.

2.4.2.2. Wiring Interconnections for DeviceNet Communications

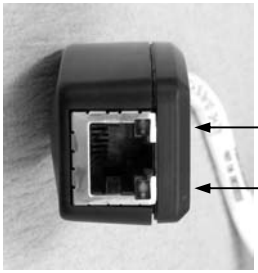


2.4.3. Ethernet Connections

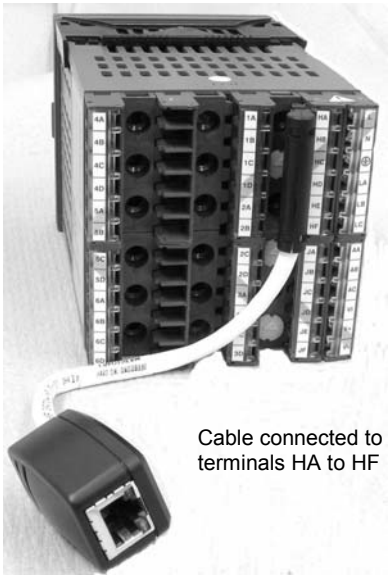
When the controller is supplied with the Ethernet communications option a special cable assembly is also supplied. This cable must be used since the magnetic coupling is contained within the RJ45 connector. It consists of an RJ45 connector (socket) and a termination assembly which must be connected to terminals HA to HF.

Use standard CAT5 cable to connect to the Ethernet 10BaseT switch or hub. Use cross-over cable only if connecting one-to-one with a PC acting as network master

View of cable which may also be ordered separately as Part No SUB27/EA



Activity and power on LED indicators

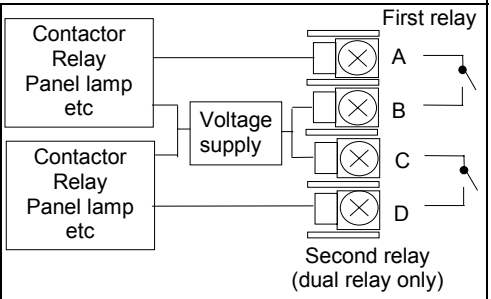
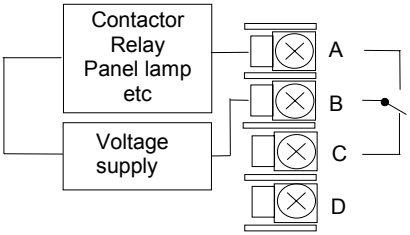
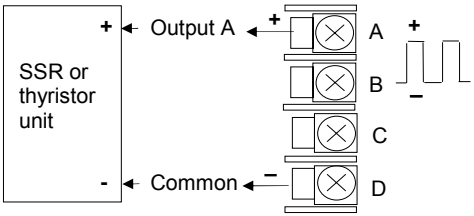


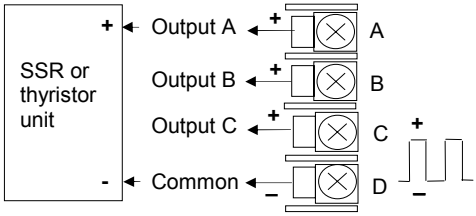
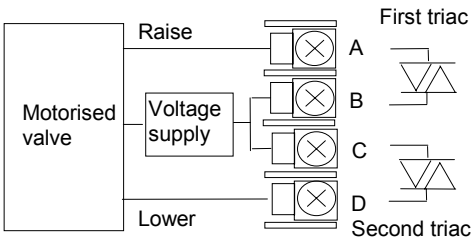
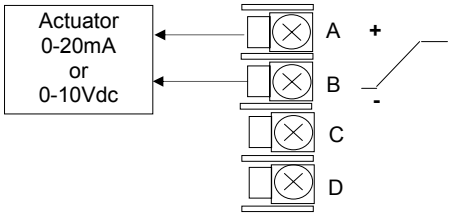
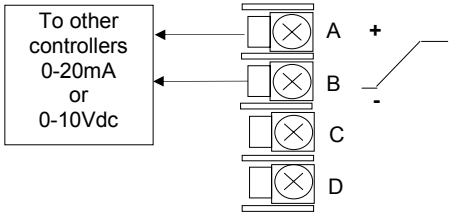
Cable connected to terminals HA to HF

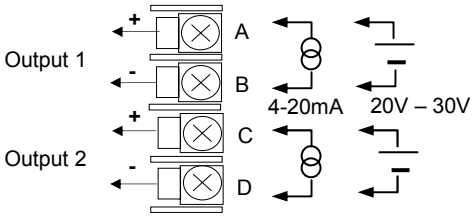
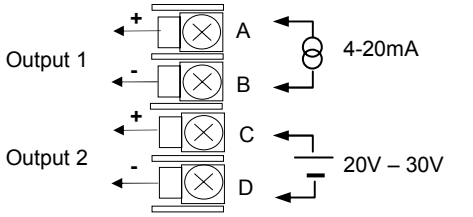
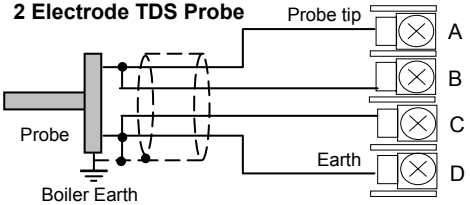
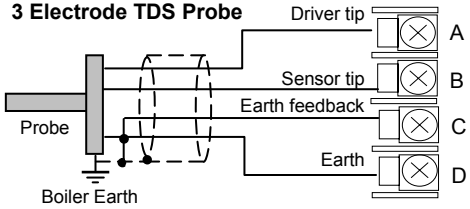
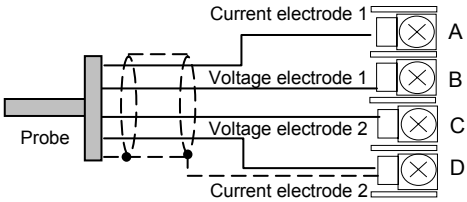
2.4.4. I/O Modules

The 2704 controller contains five positions in which 4-terminal I/O modules can be fitted. These positions are marked Module 1, Module 3, Module 4, Module 5, Module 6, in Figure 2-3. Module 2 is reserved for the Memory Module which can only be fitted in this position. To find out which modules are fitted check the ordering code which is found on a label on the side of the instrument.

Any module, listed in this section, can be fitted in any position, except the PV input - limited to positions 3 and 6 only; and the Analogue Input module - cannot be fitted in slot 5. Care should be taken, therefore, to ensure that modules are fitted as expected from the order code. The instrument can be interrogated in 'View Config' level to locate the positions in which the modules are fitted. See Chapter 4, Access Levels. If modules have been added, removed or changed it is recommended that this is recorded on the instrument code label.

I/O Module	Typical usage	H/W Code	Connections and examples of use
Note: The order code and terminal number is pre-fixed by the module number. Module 1 is connected to terminals 1A, 1B, 1C, 1D; module 3 to 3A, 3B, 3C, 3D, etc.			
Relay (2 pin) and Dual Relay max 264Vac, 2A, min 12V, 100mA	Heating, cooling, alarm, program event, valve raise, valve lower	R2 and RR	
Change Over Relay max 264Vac, 2A, min 12V, 10mA	Heating, cooling, alarm, program event, valve raise, valve lower	R4	
Isolated Single Logic Output 18Vdc at 24mA max	Heating, Cooling, Program events	LO	

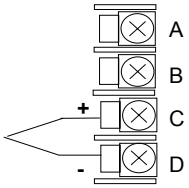
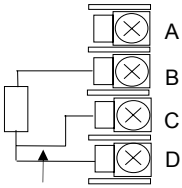
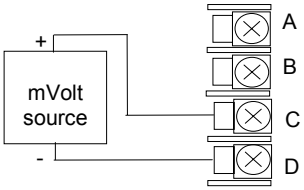
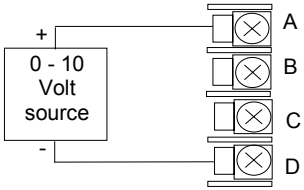
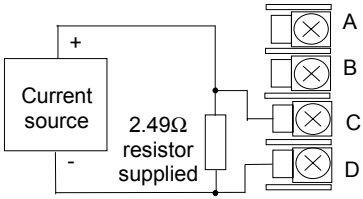
I/O Module	Typical usage	H/W Code	Connections and examples of use
Triple Logic Output (18Vdc at 8mA max. per channel)	Heating, cooling, program events	TP	
Triac and Dual Triac (0.7A, 30 to 264Vac combined rating)	Heating, cooling, valve raise, valve lower	T2 and TT	 Note: Dual relay modules may be used in place of dual triac. **Note:-** **The combined current rating for the two triacs must not exceed 0.7A.**
DC Control (10Vdc, 20mA max)	Heating, cooling e.g. to a 4-20mA process actuator	D4	
DC Re-transmission (10Vdc, 20mA max)	Logging of PV, SP, output power, etc., (0 to 10Vdc, or 0 to 20mA)	D6	

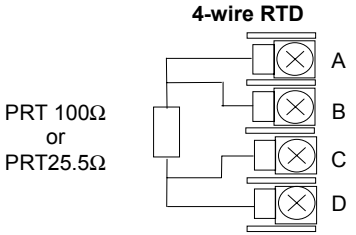
I/O Module	Typical usage	H/W Code	Connections and examples of use
Dual DC Output (each channel can be 4-20mA or 24Vdc power supply)	Control output 12 bit resolution Can only be fitted in slots 1,4 or 5	DO	
High Resolution DC Output (one 15 bit 4-20mA plus one 24V power supply	Retransmission in 'feedback mode' Fitted in slots 1,4 or 5 only	HR	
TDS Module	TDS Control in boilers		**2 Electrode TDS Probe**  **3 Electrode TDS Probe**  **4 Electrode TDS Probe** 

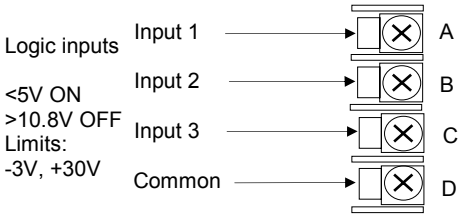
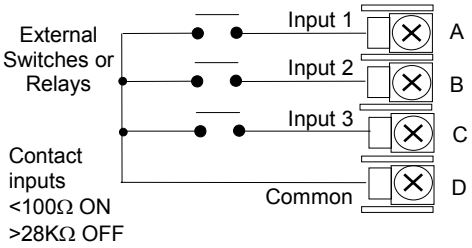
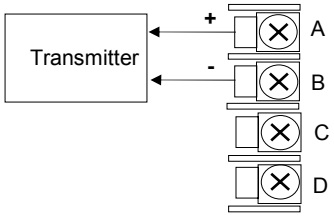
The diagrams show general wiring connections.

Connection terminals vary from supplier to supplier.

Particular attention must be made to grounding and screen connections as recommended by the supplier

I/O Module	Typical usage	Order Code	Connections and examples of use
PV Input (Modules 3 & 6 only) and **Analogue Input** (Modules 1, 3, 4 & 6 only)	Second or third PV input mV, V, mA, TC, RTD (Pt100) Zirconia probe Second or third PV input mV, mA, TC, RTD (Pt100)	PV AM	**Thermocoupl**  **3-wire RTD**  For 2-wire this is a local link **AM (up to 100mV)**  **Voltage 0 to 10V or 0 to 2V**  **Current 0 to 20mA (4 to 20mA)** 

4-Wire PRT Input (Modules 3 & 6 only)	Two special versions of the PV Input module provide high accuracy, high stability temperature measurement. Code PH is PRT 100Ω Code PL is PRT 25.5Ω	PH PL	 Use screened wires if longer than 30 metres

I/O Module	Typical usage	Order Code	Connections and examples of use
Triple Logic Input	Events e.g. Program Run, Reset, Hold	TL	
Triple Contact Input	Events e.g. Program Run, Reset, Hold	TK	
24V Transmitter Supply (20mA)	To power an external transmitter	MS	

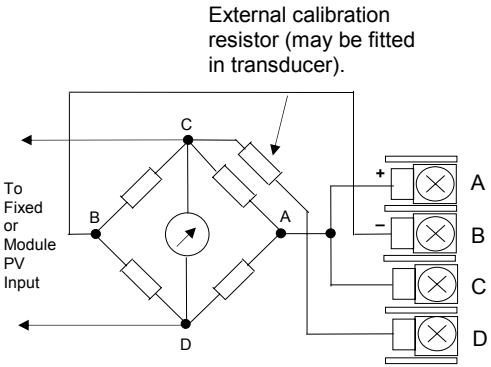
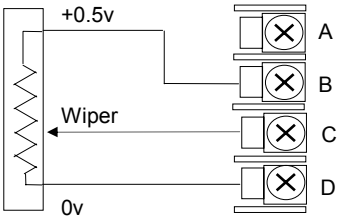
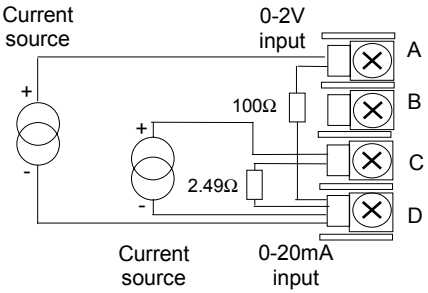
Transducer Power Supply	Provide 5V or 10Vdc to power Strain Gauge Transducer + Shunt Contact	G3 or G5	 Note: To minimise noise pick up it is recommended that screened cables are used for strain gauge power supply connections.
Potentio-meter Input (100Ω to 15KΩ)	Motorised valve position feedback Remote SP	VU	
Dual PV Input (Modules 3 & 6 only)	To accept two inputs from a high level and a low level source. The two inputs are not isolated from each other.	DP	 The common connections to terminal D must be returned separately to D as shown in the dual current example above.

Figure 2-15: Wiring Connections for IO Modules

2.5. TO CONNECT ZIRCONIA (DUAL SIGNAL) PROBE

A dual signal probe, such as a Zirconia probe, will normally be connected to a Dual PV Input module (Code DP). The module presents two channels, A and C, where A is the voltage input and C is the mV, thermocouple, RTD or mA input.

Example 1 shown below uses the Dual PV Input module with both channels configured. In this configuration the module runs at 4.5Hz. The two channels are un-isolated from one-another but isolated from the rest of the instrument.

Example 2 uses two modules. The modules can either be two PV Input modules (code PV) or a Dual PV Input module (code DP) with Channel C configured as 'None' plus a PV Input module. This combination runs at 9Hz and may be used if the loop is unusually fast.

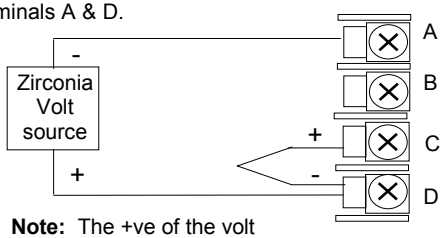
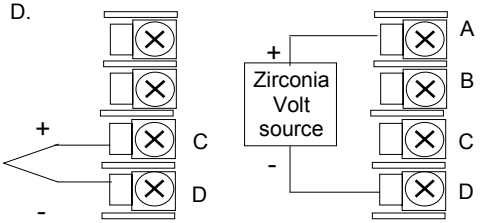
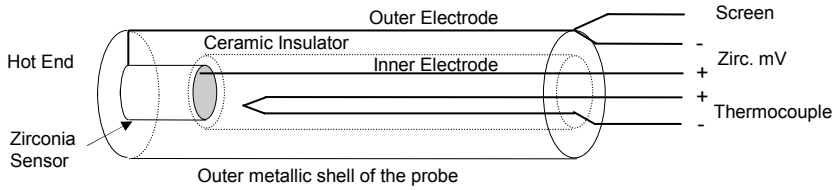
I/O Module	Typical usage	Order Code	Connections and examples of use
Dual PV Input	Zirconia probe	DP	**Example 1:- Using the Dual PV Input Module.** Channel C is shown configured for thermocouple. The temperature sensor of a zirconia probe is connected to this input, terminals C & D. The Volt Source is connected to the A channel, terminals A & D.  **Note:** The +ve of the volt source must be connected to the-ve of the thermocouple.
Two PV Input Modules		PV	**Example 2:- Using Two Modules** The temperature sensor of the zirconia probe can be connected to the precision PV input of one I/O module, connections C & D, with the Volt Source connected to the second module, terminals A & D. 

Figure 2-16: Wiring Connections for Zirconia Probe

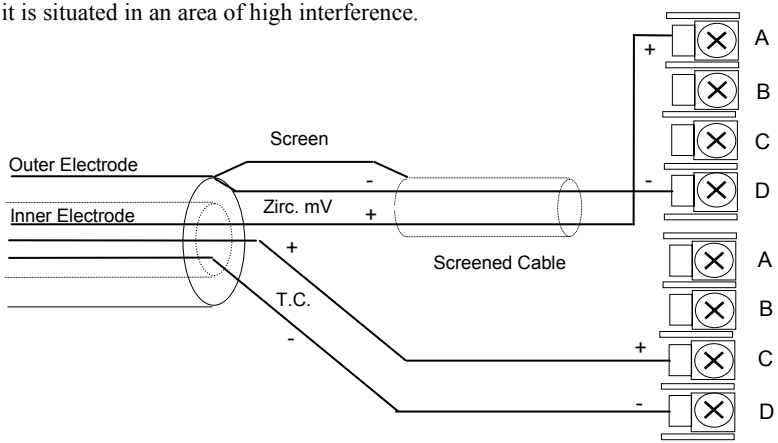
2.5.1. Zirconia Probe Screening

2.5.1.1. Zirconia Carbon Probe Construction



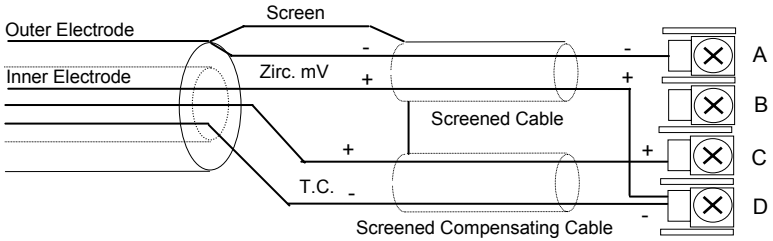
2.5.1.2. Screening connections when two modules are used

The zirconia sensor wires should be screened and connected to the outer shell of the probe if it is situated in an area of high interference.



2.5.1.3. Screening connections when a dual input module is used

Both the thermocouple and the zirconia sensor wires must be screened and connected to the outer shell of the probe if it is situated in an area of high interference.
Note the reverse connection of the zirconia sensor .



3. CHAPTER 3 GETTING STARTED 2

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3. Chapter 3 GETTING STARTED

With the controller installed, as described in the previous chapter, this chapter explains the principle of how to locate and change values of parameters using the front panel buttons.

Operation of these buttons changes the information on the display by opening different pages. Each page is associated with a particular aspect of the operation of the controller. The navigation between the pages follows a set order and the principle of this navigation is described in this chapter.

Subsequent chapters describe the detail of each page and follow the order in which the pages appear on the controller.

Note: The 2704 controller is an application specific controller and can be configured to the preferences of a particular process, site or user. This means that the displays shown in this and following chapters may not be identical to those shown in your instrument. Where the text on a display is user configurable it is shown in italics, eg *Loop1*

About this chapter

This chapter describes:

◊ How to change setpoint

◊ The operator buttons

◊ Parameters and how to access them

◊ Pages

◊ How to step through pages

◊ How to step through parameters

◊ How to change parameter values

◊ The navigation diagram

◊ Parameter tables

The 2704 contains different levels of user access. Unless otherwise stated this Getting Started guide assumes operation in Level 1. This is the default level when the controller is first switched on. For operation in other levels refer to the 2704 Engineering Handbook. If the controller has been operating in a higher level this level will be retained if the controller is switched off and on again.

3.1. POWER UP

Install and wire up the controller in accordance with Chapter 2 and switch on. A short self test sequence takes place during which the controller identification is displayed together with the version number of software fitted.

3.1.1. The HOME Page

The controller then shows a default display, referred to as the HOME page. It is possible to configure the HOME page to suit the preferences of the process or the user, but the format is shown in Figure 3-1. This is also the default display on a new controller.

The HOME page will be displayed under the following conditions:-

1. When the controller is switched on
2. When the access mode is changed from configuration level to an operating level
3. When [page] and [refresh] are pressed together (see 3.10)
4. When a timeout (if configured) occurs

The HOME page can be configured as:-

1. Summary Page
2. The Program Run page
3. Loop Views - LP1 (as shown in Figure 3-1), LP2, LP3
4. The Access page
5. Cycle Each Loop. LP1 to LP3 pages are cycled in turn
6. All Loops (summary of 2 or 3 loops if configured)
7. LP1, LP2, LP3 Trend Charts (PV & SP for each loop)
8. Program Mimic
9. User Pages 1 to 8
10. Vacuum

The configuration of these displays is described in the Engineering manual, Part No. HA026933.

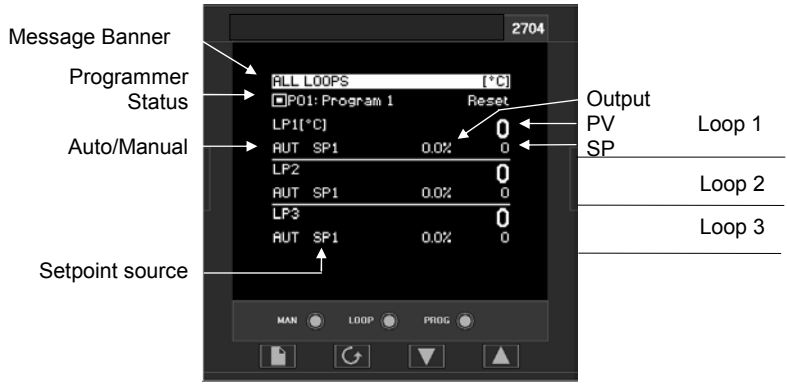
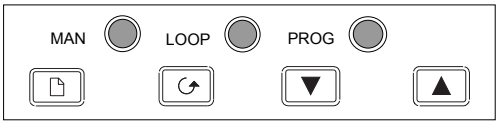


Figure 3-1: The 'HOME' Page (default)

3.2. THE OPERATOR BUTTONS



AUTO	Auto/Manual button	When pressed, this toggles between automatic and manual mode: • If the controller is in automatic mode 'AUT' is displayed • If the controller is in manual mode, 'MAN' is displayed See Figure 3-1
LOOP	Loop select button	Each press selects an overview of each loop configured. This includes trend charts, loop summaries or other customised displays if these have been configured. *The loop name is shown in the banner at the top of the display*
PROG	Programmer button This button operates the programmer on all loops For further details see Chapter 6 'Programmer Operation'	• Press once to display a pop up window The pop up window shown here is for the synchronous programmer. It allows you to select the program, set a delayed start time and run, hold and reset the program. • Press PROG again to RUN a program • Press PROG again to HOLD a program • Press PROG again to toggle between RUN & HOLD • Press PROG and hold for two seconds to reset If no button is pressed for approximately 6 seconds the pop-up disappears:-
	Page button	Press to select the Page Header 'Menu'.
	Scroll button	Press to select a new parameter from the page heading. If held down it will continuously scroll through the parameters.
	Down button	Press to decrease an analogue value, or to change the state of a digital value
	Up button	Press to increase an analogue value, or to change the state of a digital value

Note:- The AUTO, LOOP, or PROG may have been disabled in configuration level.

Figure 3-2: Operator Buttons

3.3. THE PROG BUTTON

If the controller is configured as a programmer this button has three functions:

- To put the programmer into **RUN** mode. This causes the working setpoint to follow the profile set in the program being used.
- To put the programmer into **HOLD** mode. This stops the program from running and maintains the setpoint at the current level..
- To put the programmer into **RESET** mode. This resets the programmer to the controller setpoint, the working setpoint can be changed manually using the Raise/Lower buttons.

This button operates all programmer setpoints simultaneously.

3.4. THE LOOP SELECT BUTTON

If more than one loop is configured, the Loop Select button allows you to select a summary of each loop from whatever page is being displayed at the time. Each press of the Loop Select button will change the display from the 'ALL LOOPS' view to 'Loop 1' summary to the 'Loop 1 Trend' chart, followed by the next loop summary, and so on.

By default a loop is designated by the mnemonic 'LP' followed by the loop number (1, 2 or 3). This is shown in the banner at the top of the display page. The default message may be replaced by a customised name for the loop.

To return to the original page view at any time, press the page button, . Alternatively, a timeout may have been set which will return the display to the HOME page view after a set period. The timeout is set in configuration level, see Engineering Manual part no HA026933.

If only one loop is configured the display toggles between 'LP1' and 'LP1 Trend', (the 'ALL LOOPS' page is not shown).

If a programmer is configured the 'Programmer Mimic' display may also be selected using the Loop Select button

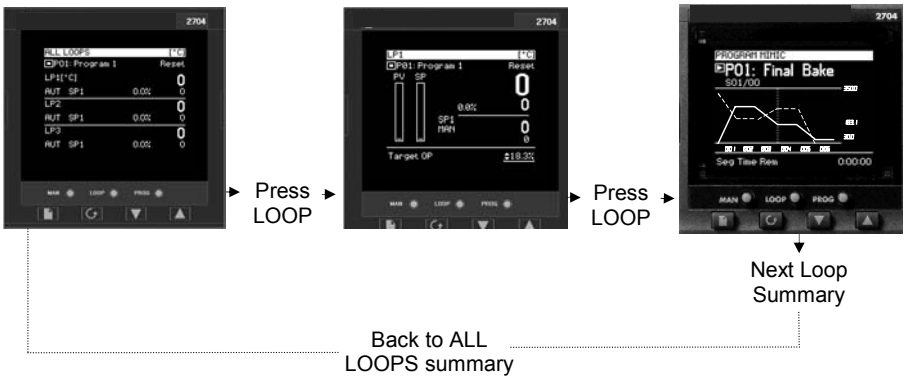


Figure 3-3: Loop Summary and Loop Trend Chart

3.5. THE AUTO MANUAL BUTTON

The controller has two basic modes of operation:

- **Automatic Mode** in which the control output is automatically adjusted to maintain the process value at the setpoint .
- **Manual Mode** in which you can adjust the output independently of the setpoint.

The Auto/Manual button can only be operated from the loop view. Press the Loop Select button to select the loop view, then press **AUTO/MAN** to toggle between auto and manual. When the controller is in **AUTO**, 'AUT' will be displayed on the page (see Figure 3-4). The middle readout will default to the **Working Setpoint** in a standard controller.

When the controller is in **MANUAL**, 'MAN' will be displayed on the page (see Figure 3-5). The middle readout will default to **Output Power** in a standard controller.

If the loop summary page is not being viewed when the AUTO/MAN button is pressed, the display will change to the first available loop summary. Subsequent presses will change between Auto and Manual for the selected loop as above.

If the output is configured as On/Off, the output will be Off when the target output < 0.9 and On when the target output is > $\pm$1.0.

3.5.1. To Change Setpoint (when the loop is in Auto)

A flashing bar underlines the selected parameter (setpoint)

Press and hold the ▼ button to decrease the setpoint

Press and hold the ▲ button to increase the setpoint

Figure 3-4: Changing Setpoint

3.5.2. To Change Output Power (when the loop is in Manual)

A flashing bar underlines the selected parameter (output power)

Press and hold the ▼ button to decrease the output

Press and hold the ▲ button to increase the output

Figure 3-5: Changing Output Power

3.6. PARAMETERS AND HOW TO ACCESS THEM

Parameters are settings, within the controller, which determine how the controller will operate. They are accessed, using the and buttons, and can be changed, to suit the process, using the and buttons.
Selected parameters may be protected under different security access levels.

Examples of parameters are:-
Values - such as setpoints, alarm trip levels, high and low limits, etc.,
or
States - such as auto/manual, on/off, etc. These are often referred to as enumerated values.

3.6.1. Pages

The parameters are organised into different pages. A page shows information such as page headers, parameter names and parameter values.

Parameters are grouped in accordance with the function they perform. Each group is given a '**Page Header'** which is a generic description of the parameter group. Examples are 'The Alarm Page', 'The Programmer Page', etc,. A complete list of these is shown in the full navigation diagram, Section 3.9.

Where a function has many parameters associated with it, the Page Header may be further sub divided into **'Sub-Headers'.** The parameters are then found under this category.

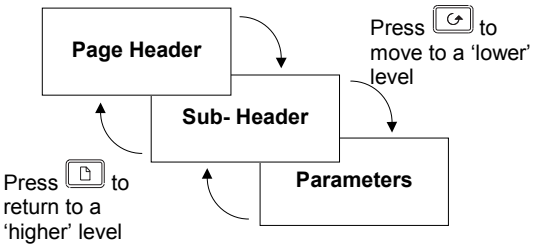


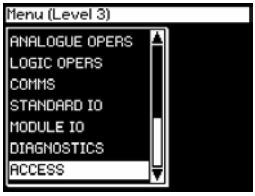
Figure 3-6: Page Types

It is possible to configure different start up pages as the Home page, but the principle of navigation is the same for all pages.

Note:-
A page only appears on the controller if the function has been ordered and has been enabled in Configuration mode. For example, if a programmer is not configured the RUN page and the EDIT PROGRAM pages will not be displayed.

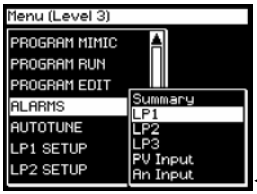
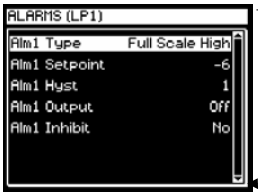
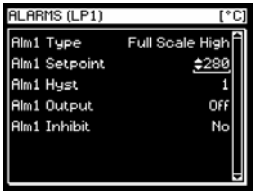
3.7. NAVIGATION OVERVIEW

3.7.1. To Select a Page Header

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [▯] as many times as necessary to access the page header menu		The curser highlights the previously selected.page name (e.g. PROGRAM MIMIC). The vertical bar on the right of the display indicates the position of the page header.
2. Press [▼] to scroll down the list of page headers.		When the curser reaches the centre of the screen the **text** moves up. This feature allows you to see previous and following page header names.
3. Press [▲] to scroll back up the list of page headers.		When the last name in the Page Header list appears at the bottom of the display, the curser will continue to move downwards.
	The sequence is repeated following further presses of [▼] button	

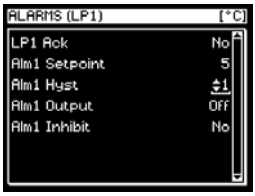
i The views shown above, and in subsequent sections, are taken at Level 3 to illustrate the way in which the cursor behaves when the page contains more lines or parameters than can be shown in a single view.
In level 1, for example, the page will only be full if headings have been promoted during configuration of the controller (see Engineering Handbook). When the page is not full the cursor simply moves up and down the page.

3.7.2. To Navigate to a Parameter from a Page Header.

Do This	This Is The Display You Should See	Additional Notes
1. From any page press [▯] as many times as necessary to select the list of **Page Headers** 2. Press [▲] or [▼] to scroll up or down the list of page headers.		The ▸ symbol indicates that the page header is followed by a list of sub-headers.
	Press [▯] to return to Page Header	
3. Press [↷] to select the list of **Page Sub-Headers** for the highlighted Page Header. 4. Press [▲] or [▼] to scroll up or down the list of page sub-headers		If a page does not contain a Sub-Header the display goes directly to 5 below
	Press [▯] to return to Sub- Header	
5. Press [↷] to select the list of **Parameters** in the highlighted sub-header. 6. Press [▲] or [▼] to scroll up or down the list of parameters.		
	Press [▯] to return	
7. Press [↷] to select the parameter which you wish to change 8. Press [▲] or [▼] to change the value		A flashing bar underlines the selected parameter. The parameter can only be altered if the value is preceded by ▲▼ If the value is read only it will be replaced by **'- -'** for as long as the raise or lower buttons are pressed

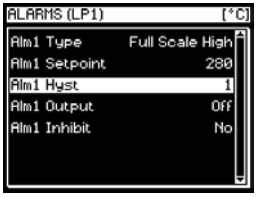
3.7.3. To Change the Next Parameter in the List

This sections describes how to select further parameters in the list which you may wish to alter or to view.

Do This	This Is The Display You Should See	Additional Notes
1. From the previous display, press [↻] to select the next parameter you wish to change 2. Press [▲] or [▼] to change the value		The [↻] button will allow you to scroll down the list. If this button is held down it will continuously scroll around the list, which will enable you to change a previous parameter.

3.7.4. To Change Any Parameter in the List

As stated above you can keep pressing or hold down the [↻] button to continuously scroll around the list of parameters. There are two other alternatives.
The first is to return to the highlight bar, described below.
The second is 'Backscroll' described in the next section.

Do This	This Is The Display You Should See	Additional Notes
1. From the previous display, press [🗋] to highlight the parameter value and its name. 2. Press [▲] or [▼] to scroll up or down the list.		

3.8. BACKSCROLL

In some cases it may be more convenient to scroll back up the list, for example, to select a new segment number when setting up a program.
A short cut is provided by holding down [ ] and pressing [▲] or [▼].

Each press of [▲] will step back to the previous parameter. Each press of [▼] will step forward to the next parameter.

This function is provided as a short cut and is not necessary to navigate through the parameters.

3.8.1. Confirmation Mechanism

Having changed a value, when the [▲] or [▼] key is released, the display will blink after a period of 1.5 seconds, indicating that the new parameter value has been accepted. If any other key is pressed during the 1.5 second period the parameter value is accepted immediately.

There are exceptions for specific parameters. Examples of these are:-

Output Power adjustment when in Manual mode. The value is written continuously as the value is changed.

Alarm Acknowledge. If the Alarm Acknowledge is changed from 'No' to 'Acknowledge' a confirmation message appears. Press [ ] key to confirm the change. If no key is pressed for 10 seconds the value is restored to its previous value.

3.8.2. Invalid key actions

At any time some state transitions may be invalid, due, for example, to contention with digital inputs or to the current operating state of the instrument.
Examples are:-

1. Digital inputs have priority over the operator buttons.
2. If a parameter value cannot be changed the ▲▼ prompt is not shown
3. If the [▲] or [▼] button is pressed for a read only parameter a number of dashes, ----, is displayed.

3.9. NAVIGATION DIAGRAM

The Navigation Diagram shows an example of typical pages available at Levels 1 & 2.
For a particular configuration, additional pages may have been promoted to or removed. For example, the programmer pages do not appear if a programmer is not configured. The simplest view shows ACCESS and ALARMS page headers only.

A full Navigation Diagram is shown in the 2704 Engineering Manual Part No HA026933.

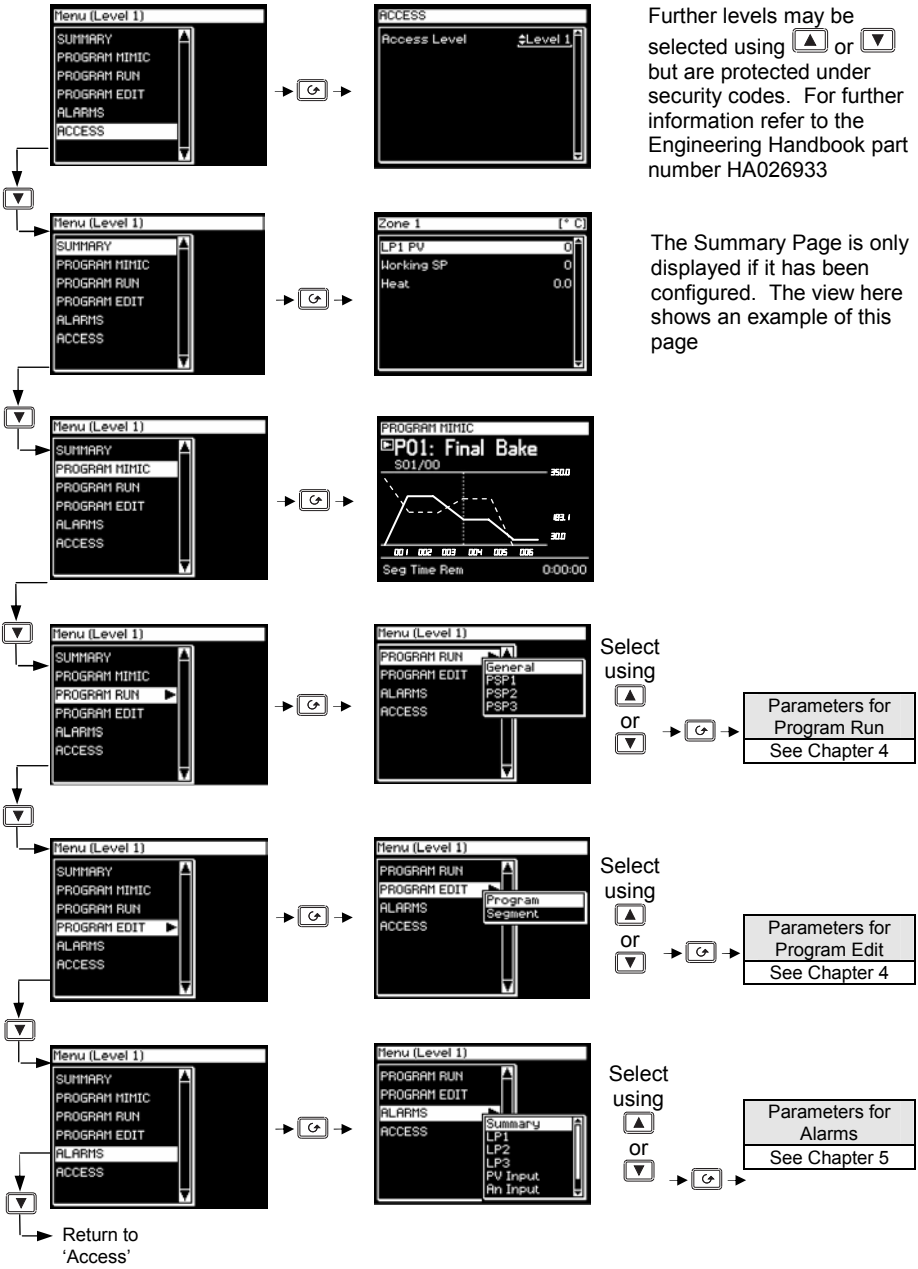
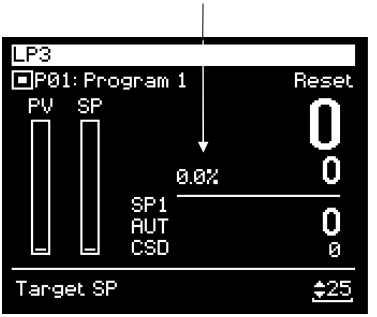


Figure 3-7: Navigation Diagram

3.10. EXAMPLES OF ALTERNATIVE DISPLAYS

3.10.1. Cascade Controller

The Loop Summary, displayed in previous views in this chapter, shows a controller configured as 'Single' loop. The Loop Summary view, for controllers configured as cascade, ratio, override or valve position varies as shown in this section.
For more information on these methods of control see Engineering Handbook.



← Master PV
← Master SP
← Slave PV
← Slave SP
← This line may show different parameters

Press [↻] to show alternatives. The defaults are:

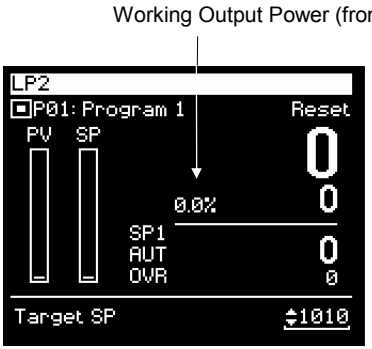
Target Setpoint	The main SP	Press
Target OP	Output demand	[▲]
VPos	Valve position (VP controller only)	or
Local SP	Local (Slave) setpoint	[▼]
Disable CSD	Allows cascade to be turned off eg for commissioning purposes	to adjust the value.

Note:

1. The parameter displayed first depends upon other settings. For example; if controller is in Auto the Target SP is displayed first; if the controller is in Manual the Target OP is displayed first.
2. In configuration level it is possible to hide or make individual parameters read only.

Figure 3-8: Cascade Loop View

3.10.2. Override Controller



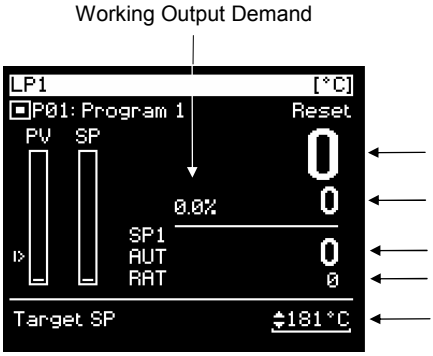
Target SP	The main setpoint	Press
Target OP	Output demand	▲
VPos	Valve position (VP controller only)	
OvrSP	Override setpoint	. or
Disable OVR	Allows override to be turned off eg for commissioning purposes	
Active Loop	Displays the active loop - Main or Override	▼
Main OP	Reads the output demand for the main loop	to adjust
Override OP	Reads the output demand for the override loop	the value

Note:

1. The parameter displayed first depends upon other settings. For example; if controller is in Auto the Target SP is displayed first; if the controller is in Manual the Target OP is displayed first.
2. In configuration level it is possible to hide or make individual parameters read only.

Figure 3-9: Override Loop View

3.10.3. Ratio Controller



Press ⟳ to show alternatives. The defaults are:

Target SP	The main setpoint	Press
Target OP	Output demand	▲
VPos	Valve position (VP controller only)	. or
Ratio SP	Ratio setpoint	▼
Enable Ratio	Allows ratio to be turned on eg for commissioning purposes	to adjust
Ratio Trim	Applies a trim to the ratio SP	the value
Lead PV	The measured flow 1	

Note:

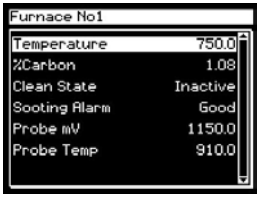
1. The parameter displayed first depends upon other settings. For example; if controller is in Auto the Target SP is displayed first; if the controller is in Manual the Target OP is displayed first.
2. In configuration level it is possible to hide or make individual parameters read only.

Figure 3-10: Ratio Loop View

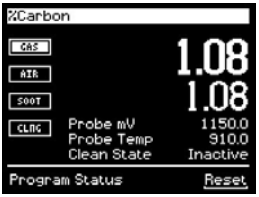
3.10.4. User Pages

User Pages allow the user to place a pre-determined number of parameters onto a set of semi-custom screens. There are up to eight styles available and they are fully described in the 2704 Engineering Handbook Part No. HA026933.

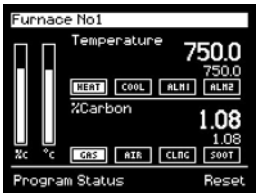
Examples of these styles are shown below.



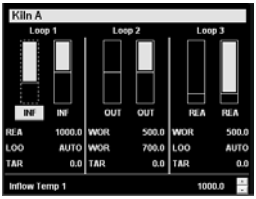
Parameter List User Page



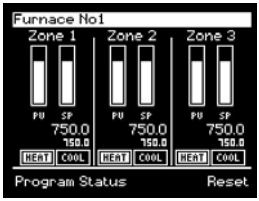
Single Loop User Page
(configured as Carbon)



Dual Loop User Page
(configured as Carbon/Temperature)

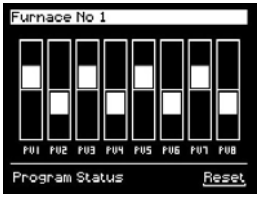

Kiln A
Loop 1 Loop 2 Loop 3
INF INF OUT OUT REA REA
REA 1000.0 WOR 500.0 WOR 500.0
LOO AUTO WOR 700.0 LOO AUTO
TAR 0.0 TAR 0.0 TAR 0.0
Inflow Temp 1 1000.0

Triple Loop User Page 1



Triple Loop User Page 2

Status Grid User Page



Bar Graph User Page

Blank Page

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4. Chapter 4 PROGRAMMER OPERATION

This chapter explains:-

- The features of a setpoint programmer in general
- How to run and edit a Synchronous Programmer
- How to run and edit an Asynchronous Programmer (software versions 6 onwards)

Customisable Parameter Names

Throughout this chapter parameter names shown in *italics* are customisable by the user when in configuration access level. The name of the parameter may vary, therefore, from instrument to instrument.

Typical customisable parameter names are:

- Program names
- Profile Setpoint names
- Segment names
- Digital Event Names

4.1. WHAT IS SETPOINT PROGRAMMING ?

In a setpoint programmer you can set up a profile in the controller in which the setpoint varies in a pre-determined way over a period of time. Temperature is a very common application where it is required to 'ramp' the process value from one level to another over a set period of time.
The 2704 controller will program up to three separate profiles. These may be temperature, pressure, light level, humidity, etc., depending on the application, and are referred to as **Profiled Setpoints (PSPs).**

The **Program** is divided into a flexible number of **Segments** - each being a single time duration, - and containing details for each profiled setpoint. The total number of segments available is **100 per program** with a **maximum of 600** for the Time to Target Programmer and **480** for the Ramp Rate programmer.

The 2704 programmer may store up to 20 programs as standard, with up to 60 if purchased.

It is often necessary to switch external devices at particular times during the program. Digital 'event' outputs can be programmed to operate during those segments.

4.1.1. Synchronous Programmer

In a synchronous programmer all PSPs are run on a common timebase. That is, they all start at the same time and the time duration of a segment is the same for each PSP. This is shown in Figure 6.1.

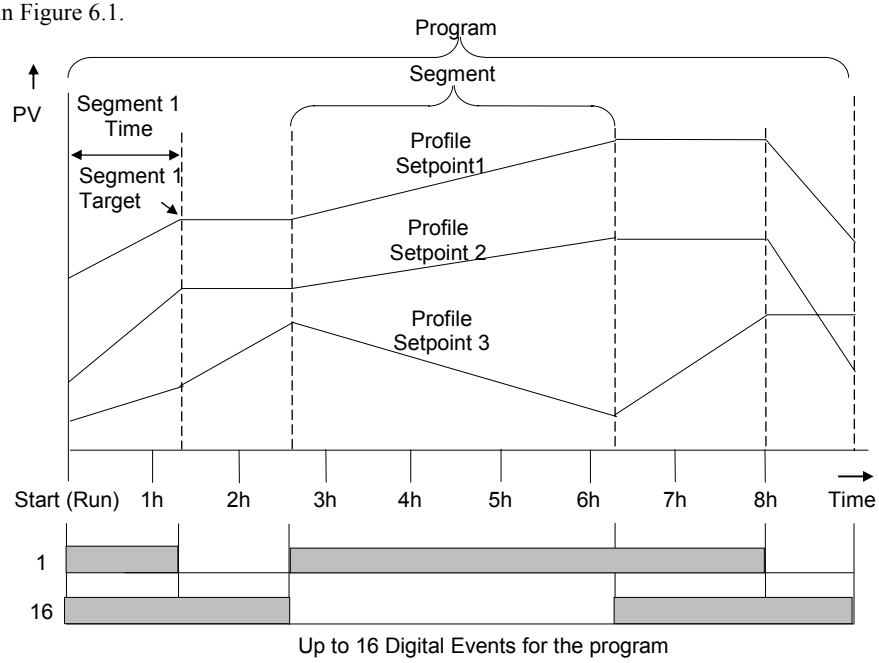


Figure 4-1: An Example of a Synchronous Setpoint Program

4.1.2. Asynchronous Programmer

In an asynchronous programmer up to three PSPs can be run with a different number of segments, based on an independent time base. Each PSP can start at the same time or can be started individually.

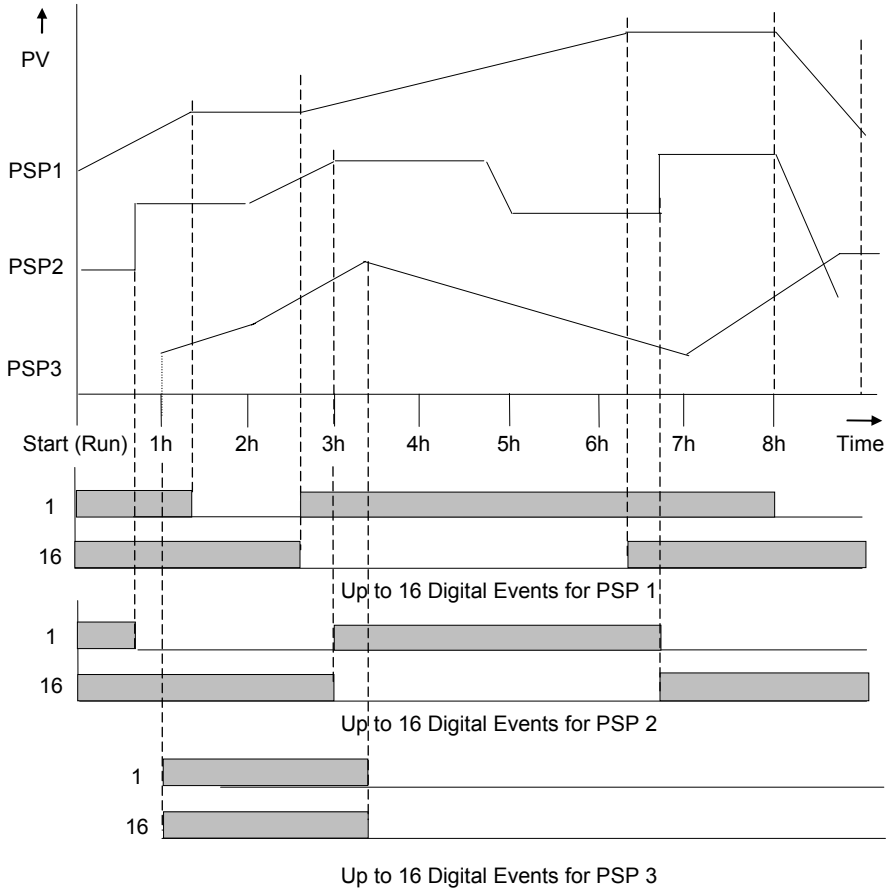


Figure 4-2: An Example of an Asynchronous Setpoint Program

The operation of the synchronous programmer is described in the first part of this chapter; the operation of the asynchronous programmer is described in the last part of this chapter where it differs from the synchronous programmer.

4.2. SETPOINT PROGRAMMER DEFINITIONS

This section defines the more common parameters to be found when running a 2704 programmer /controller. For an explanation of further features see the Engineering Handbook part no HA026933.

4.2.1. Run

In run the programmer varies the setpoint in accordance with the profile set in the active program.

4.2.2. Hold

In hold the programmer is frozen at its current point. In this state you can make temporary changes to program parameters such as a target setpoint, ramp rates and dwells (if programmer configured for ramp rate) or segment duration (if programmer configured as Time to Target). Such changes will only remain effective until the end of the currently running segment, when they will be overwritten by the stored program values.

4.2.3. Reset

In reset the programmer is inactive and the controller behaves as a standard controller, with the setpoint determined by the raise/lower buttons.

4.2.4. Servo

Servo can be set in configuration so that when a program is run the setpoint can start from the initial controller setpoint or from the current process value. Whichever it is, the starting point is called the servo point. This can be set in the program.
Servo to PV is the default and will produce a smooth and bumpless start to the process.
Servo to SP may be used in a Ramp Rate programmer to guarantee the time period of the first segment. In this case it is necessary to soft wire the Working Setpoint parameter to the PSP Reset Value parameter. (Note: in a Time to Target programmer the segment duration will always be determined by the setting of the Segment Duration parameter.)

4.2.5. Hot Start

When run is initiated Hot Start allows the program to automatically advance to the correct point in the profile which corresponds to the operating value of the process. It can occur in any segment type, for any PSP but is most useful to ramp segments. Hot start is enabled in configuration level and specifies which programmed variable to use when deciding the correct segment.

4.2.6. HOLDBACK (GUARANTEED SOAK)

Holdback freezes the program if the process value does not track the setpoint by an amount settable by the user. It may operate in any PSP type.
In a **Ramp** it indicates that the process value is lagging the setpoint by more than a settable amount and that the program is waiting for the process to catch up.
In a **Dwell** it will freeze the dwell time if the difference between SP and PV exceeds settable limits.
In both cases it guarantees the correct soak period for the product.

- Holdback can apply to the complete program or to each individual segment or it may have been turned off in the configuration of a particular controller.

Example:
Holdback applied to a ramp up and a dwell.

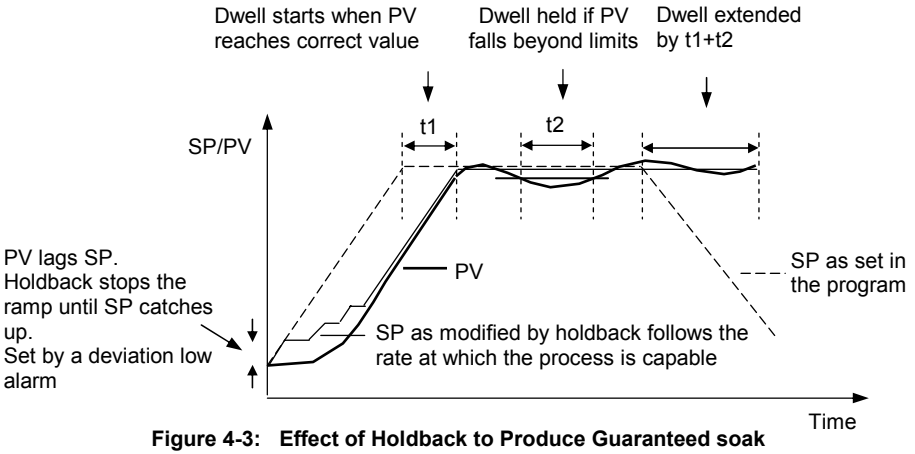

Dwell starts when PV reaches correct value
Dwell held if PV falls beyond limits
Dwell extended by t1+t2
t1
t2
SP/PV
PV lags SP. Holdback stops the ramp until SP catches up. Set by a deviation low alarm
PV
SP as set in the program
SP as modified by holdback follows the rate at which the process is capable
Time

Figure 4-3: Effect of Holdback to Produce Guaranteed soak

4.2.7. External Program Inputs

Digital inputs may have been configured to operate the program from external sources.

Run	Allows the program to be run from a pushbutton or other event
Hold	Allows the program to be held from a switch or other event.
Reset	Allows the program to be reset from a pushbutton or other event.
Run/Hold	Allows the program to be run or held from a single external source
Run/Reset	Allows the program to be run or reset from a single external source
Advance Segment	Selects the next segment from an external source
Advance Program	Selects the next program from an external source. When this event occurs, the controller display will change to programmer view. Subsequent changes of this source will cause the program number to increment.
Holdback disabled	Disables holdback from an external source

4.2.8. Wait

An event can be configured at the end of each segment, which, when active, will cause the program to wait before progressing to the next segment. Three wait conditions are provided which may be wired, in configuration level, to an external source using digital inputs or to internal sources, e.g. a loop alarm. Each segment may then select No-Wait, Wait on Event A, Wait on Event B or Wait on Event C. In a synchronous programmer the program will not proceed until all profile segments are complete.

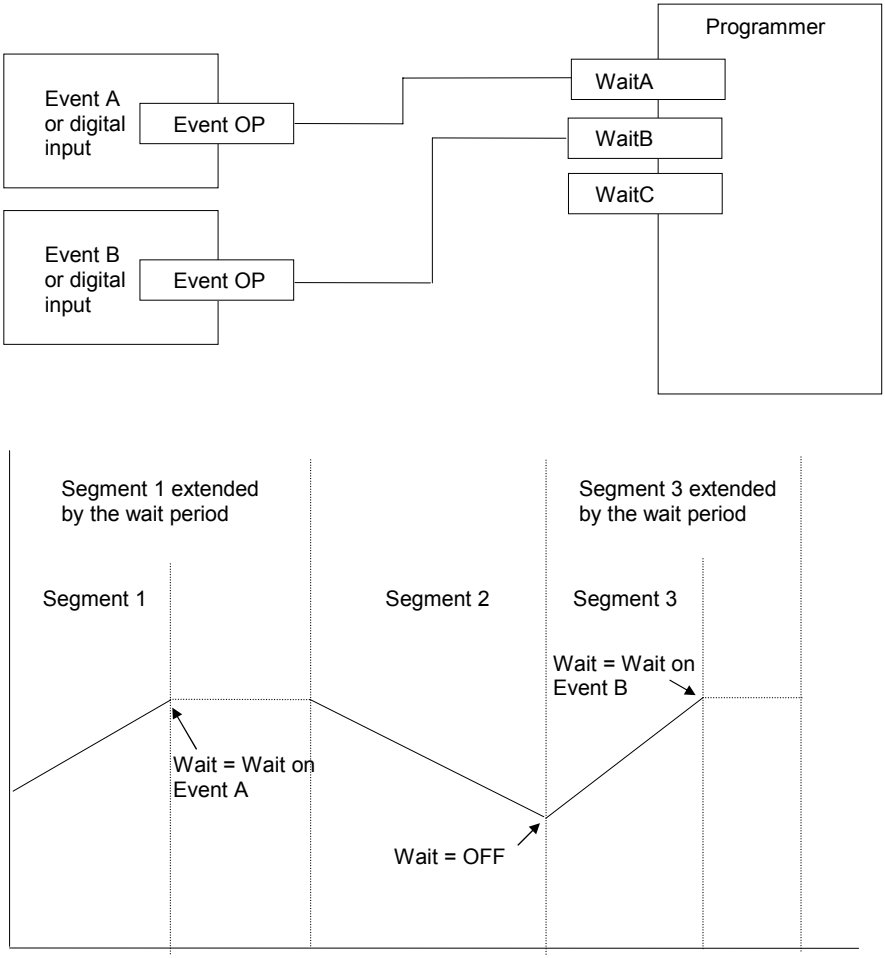


Figure 4-4: Wait Events

4.3. PROGRAMMER TYPES

The programmer can be configured as **Time to Target** or **Ramp Rate.** A time to target programmer requires fewer settings and is simple to use since all segments are the same. A time to target programmer can, in general contain more segments than a ramp rate.

4.3.1. Time To Target Programmer

Each segment consists of a **single duration parameter** and a set of **target values** for the profiled variables.

1. The **duration** specifies the time that the segment takes to change the profiled variables from their current values to the new targets.
2. A **dwell** type segment is set up by leaving the target setpoint at the previous value.
3. A **Step** type segment is set up by setting the segment time to zero.

4.3.2. Ramp Rate Programmer

Each segment can be specified by the operator as **Ramp Rate, Dwell or Step**.

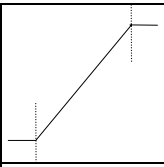
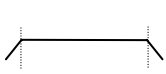
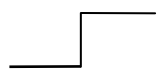
1. Each profiled setpoint must complete its segment before the programmer will move to the next segment. If one ramp reaches its target setpoint ahead of the other variables, it will dwell at that value until the other variables have completed. The program will then move to the next segment.
2. The duration parameter for a segment is read only. In this case the dwell period can be changed when the program is in Hold.
3. The duration is determined by the longest profile setting.

4.4. SEGMENT TYPES

A segment type can be defined as **Profile, Go Back To** or **End.**

4.4.1. Profile

A profile segment may be set as:-

Ramp		**The setpoint ramps linearly**, from its current value to a new value, either at a set rate (called *ramp-rate programming*), or in a set time (called *time-to-target programming*). You must specify the ramp rate or the ramp time, and the target setpoint, when creating or modifying a program.
Dwell		**The setpoint remains constant** for a specified period at the specified target. When creating programs the target is inherited from the previous segment.
Step		**The setpoint steps instantaneously** from its current value to a new value at the beginning of a segment.

4.4.2. Go Back To Segment

Go Back allows segments in a program to be repeated by a set number of times. It is the equivalent of inserting 'sub-programs' on some controllers. Figure 4-5 shows an example of a program which is required to repeat the same section a number of times and then continue the program.
A Go Back To segment is used to save the total number of segments required in a program and to simplify setting up. When planning a program it is advisable to ensure that the end and start setpoints of the program are the same otherwise it will step to the different levels. A Go Back To segment is defined when editing a program, see section 4.9.5.

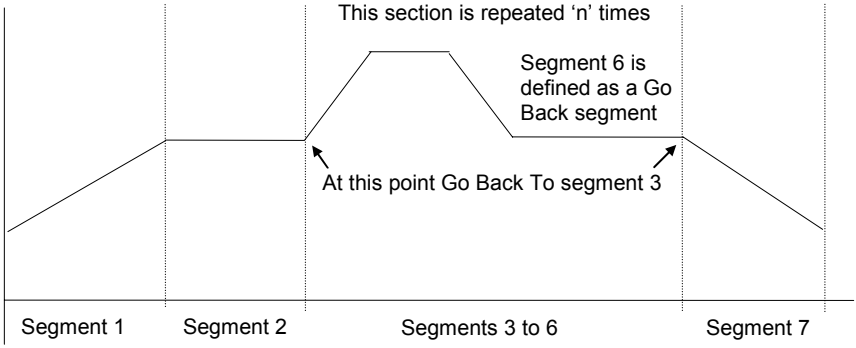

This section is repeated 'n' times
Segment 6 is defined as a Go Back segment
At this point Go Back To segment 3
Segment 1
Segment 2
Segments 3 to 6
Segment 7

Figure 4-5: An Example of a Program with Repeating Section

Note:- If a second or more 'Go Back' segments are created, they cannot return to a segment before the previous 'Go Back' segment.

4.4.3. End Segment

The last segment in a program is normally defined as an End segment
The program either ends, repeats or resets in this segment. You specify which is the case when you create, or modify, the program. When the program ends, the programmer is put into either, a continuous dwell state with all outputs staying unchanged, or the reset state.

4.5. OTHER FEATURES NOT COVERED IN THIS USER GUIDE

Program User Values	see section 6.7 of the Engineering Handbook
Pattern Generator	see section 14.11 of the Engineering Handbook
User defined names for the Program, Segments, etc	see Chapter 6, Programmer Configuration, of the Engineering Handbook

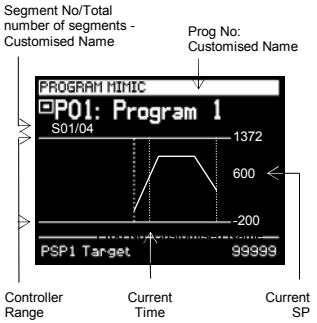
4.6. PROGRAMMER OPERATION

There are two pages associated with Programmer Operation. These are:-

1. PROGRAM MIMIC. This page shows a trend plot of a running program and is available by default in the Loop Summary page. It may also be turned off or made available in the Main Page in configuration level (see Engineering Handbook).
2. PROGRAM RUN. This shows a list of parameters associated with a running program

The Navigation Diagram, section 3.9, shows where these screens are found.

4.6.1. To Access the Program Trend Screen

Do This	This Is The Display You Should See	Additional Notes
1. From any display press **LOOP** button as many times as necessary until the Program Mimic page is displayed. 2. Press [D] to scroll through parameters shown at the bottom of the display The value of a parameter prefixed by ⬍ can be changed using [▲] or [▼]		The mimic plots the working SP for each PSP configured.

The full list of parameters is shown in the following table

4.6.2. Parameters Available on the Programmer Mimic Screen

Table Number: 4.6.2	These parameters may be shown in the lower section of the Programmer Mimic page		PROGRAM MIMIC	
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
Seg Time Rem	Segment time remaining	h: m: s		L1 R/O
PSP1 Target	*PSP1* target setpoint for the current segment	Display range		L1 R/O
PSP1 Dwell Tm	Remaining dwell time for *PSP1*	h: m: s		L1 R/O
PSP1 Rate	*PSP1* ramp rate	0.01 to display range		L1 R/O
PSP2 Target	*PSP2* target setpoint for the current segment	Display range		L1 R/O
PSP2 Dwell Tm	Remaining dwell time for *PSP2*	h: m: s		L1 R/O
PSP2 Rate	*PSP2* ramp rate	0.01 to display range		L1 R/O
PSP3 Target	*PSP3* target setpoint for the current segment	Display range		L1 R/O
PSP3 Dwell Tm	Remaining dwell time for *PSP3*	h: m: s		L1 R/O
PSP3 Rate	*PSP3* ramp rate	0.01 to display range		L1 R/O
Digital Outputs	Shows the state of each digital output configured	□■□□□■ 1 to 16 □ = Off ■ = On		L1 R/O

4.7. TO RUN, HOLD OR RESET A SYNCHRONOUS PROGRAM

Press PROG .

1. The program status pop up window is displayed
2. Press ▲ or ▼ to select the program to be run
3. Press ↻ to edit Delayed Start if it is required to run the program after a set period
4. Press ▲ or ▼ to set a time period for the delayed start
5. Press the PROG button again to select **'Run'**

The symbol in the top left of the display changes to

4.7.1. To Hold a Program

A program can only be held from Run mode. Press the '**PROG'** button once. The pop up window is again displayed showing **'Run'.** Press the **'PROG'** button again. The message in the pop up window changes to **'Hold'**.

The symbol in the top left of the display changes to.

4.7.2. To Reset A Program

Press the '**PROG'** button once. The pop up window is again displayed showing **'Run'** or **'Hold'.** Press the **'PROG'** button again and hold it pressed for 2 seconds. The message changes to **'Reset'**.

The symbol in the top left of the display changes to

4.7.3. From Digital Inputs

If digital inputs have been configured and wired for an external RUN, HOLD or RESET, activate the relevant digital input. This will normally be activated from an external switch.

4.7.4. From Digital Communications

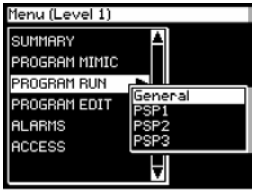
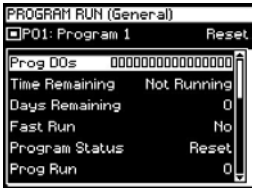
If a PC running SCADA package or iTools is connected to the controller via the digital communications module, the programmer status may be changed from this package.

4.7.5. From the PROGRAM RUN Page

This page contains a parameter called **'Program Status'**. Its value can be changed to **'Run'**, **'Hold'** or **'Reset'**. See the following section.

4.7.6. Example: To View the State of a Running Program

If you wish to know the state of the digital outputs or times remaining, for example, then you can access the 'PROGRAM RUN' pages:-

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [page] to access the page header menu. 2. Press [▲] or [▼] to select '**PROGRAM RUN**'		
3. Press [↵] to show sub-headers 4. Press [▲] or [▼] (if necessary) to select **'General'**		
5. Press [↵] to select the list of parameters for running the program.		The parameters in this view include:- • Program Status – Run Hold or Reset can be selected from this list • Current segment • Program event outputs • Time & Days remaining to end of program • Fast Run The list may be different in a particular controller depending on how it was configured

Warning!

Fast Run allows the program to be tested by quickly running through the program segments. If the controller is connected to the process, ensure that the process is not affected if fast run is selected.

The default value, **No,** means that the program will run at the set rate

The full list of possible parameters is shown in the following table

⇓

4.7.7. Run Parameter Tables

Table Number: 4.7.7a	These parameters provide information on the running program.			PROGRAM RUN (General Page)
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
Prog DOs	Digital outputs summary These are shown in this format if 'Named Dos' = 'No' The number of DO values is set by 'Num of Prog DOs' PROGRAM EDIT (Options) Not shown if Num of Prog DOs = 'None'	□□■□ (Up to 16) ■ = Off □ = On		L3
Prog DO 1 (to 16)	If programmer event outputs have been configured, then, as an alternative to the previous presentation, the event can be given a name. [PROGRAM EDIT (Options) – Named Dos? = Yes]	The name of the event is shown with its state On or Off	Off	L3
Delayed Start	Delay before the start of the program	h:mm:ss	0:00:00	L3
Time Remaining	Time remaining to end of program	Not Running or h:mm:ss		L3
Days Remaining	Number of days left for the programmer to run	0 to 255		L3
Fast Run	To fast run the program	No Yes	No	L3
Program Status	Displays the status of the program	Reset Run Hold Complete		L1
Prog Run	Programmer run status	1=running		L3
Prog Hold	Programmer hold status	1=holding		L3
Prog Reset	Programmer reset status	1=reset		L3
Prog End	Programmer end status	1=end		L3
New Seg	New segment loaded	1=new segment for 100ms		L3
Prog Time Elap	Program time elapsed	h: mm: ss	up to 24Hrs	L3 R/O
Prog Cycle Rem	Remaining number of cycles Only if 'Prog Cycles' >1	1 to 999		L1 R/O

Total Segments	Number of segments in the running program	0 to 100		L1 R/O
Segment Number	The currently running segment number	1 to 100		L1 R/O
Segment Type	Current segment type Profile = normal segment End Segment = End of prog Go Back =repeat part of prog	Profile End Segment Go Back	Profile	L1 R/O Alterable in Hold
Segment Name	A user defined name for the segment	User Text	Default Text	L1 R/O
Seg Time Rem	Time remaining in the current segment	d: h: m: s		L1. R/O Alterable if Time To Target prog and in Hold
Wait Status	Wait Status	No Wait Event A Event B Event C	No Wait	L1 R/O
Wait Condition	Wait condition for the running segment	No Wait Event A Event B Event C	No Wait	L1. Alterable in Hold
Prog User Val 1	Active User Val 1			L1
Prog User Val 2	Active User Val 2			L1
Goback Rem	Go back cycles remaining	1 to 999		L1 R/O
End Action	The state required in the end segment	Dwell Reset		L1 R/O
Prog Reset DO	Digital event outputs in Reset These are shown in this format if 'Named Dos' = 'No'	□□■□ (up to 16) ■ = Off □ = On		L1 R/O Only shown if configured
Seg Edit 1 (to 16)	If programmer event outputs have been configured, then, as an alternative to the previous presentation, the event can be given a name. [PROGRAM EDIT (Options) – Named Dos? = Yes]	The name of the event is shown with its state On or Off	Off	L3
Reset UsrVal1	Reset value for User Value 1			L1
Reset UsrVal2	Reset value for User Value 2			L1

Table Number: 4.7.7b	These parameters are associated with Profiled Setpoint number 1		PROGRAM RUN (*PSP1* Page)	
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
Seg Time Rem	Segment time remaining	h:m:s		L1
PSP1 Type	Running segment type for profiled setpoint 1	Not Used Step Dwell Ramp		L1 R/O - shown in Ramp Rate programmer only
PSP1	Working setpoint for profiled setpoint 1	Display range [1]		L1. Alterable in Hold
PSP1 Target	Running segment target for profiled setpoint 1	Display range [1]		L1. Alterable in Hold
PSP1 Dwell Tm	Time remaining in running segment for profiled setpoint 1	Display range		L1. Alterable in Hold
PSP1 Rate	Running segment rate for profiled setpoint 1	Display range [1]		L1. Not in Time To Target prog
PSP1 HBk Appl	Holdback applied for profiled setpoint 1	No Yes		L1 R/O - shown if configured

1. Range limited by user defined upper and lower limits

The above table is repeated for *PSP2* parameters and *PSP3* parameters

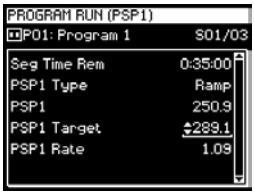
4.8. TO EDIT A RUNNING PROGRAM

From time to time it may be necessary to make temporary changes to the currently running program, for example, to change the target setpoint or to add time to a segment. The current running program can only be edited under the following conditions:-

- The program must be put into **'Hold'** or **'Reset'.** See previous section
- Changes to the currently running segment are temporary and apply only to the current run
- Permanent changes should be made in the 'PROGRAM EDIT' pages, see 4.9.5.
- Other programs can be created or edited when another program is running

4.8.1. Example; To Change the Target Setpoint or Dwell Time

In this example the changes will be made to '*PSP1'*. Place the program in **'Hold'**. Then:-

Do This	This Is The Display You Should See	Additional Notes
1. Select the '**PROGRAM RUN (*PSP1*)**' page		*PSP2* or *PSP3* may be selected if the setpoint to be changed is in this profile. Parameters printed in *italics* may have been given a user defined name
2. Press [↻] to select the list of parameters for running the program. 3. Press [↻] to scroll to '***PSP1* Target'** 4. Press [▲] or [▼] to change the value		The next parameter is *PSP1* Rate. Press [↻] to scroll to this and [▲] or [▼] to change the value [i] *PSP* Target can be set between high and low limits set in configuration level. The view shown here is for a Ramp Rate programmer.
5. Now place the program in **'Run'**		The full list of parameters is shown in the following table ⇓

4.8.2. PROGRAM RUN (*PSP1* Page)

Table Number: 4.8.2	These parameters are associated with Profiled Setpoint number 1		PROGRAM RUN (*PSP1* Page)	
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
Seg Time Rem	Segment time remaining	h: m: s		
PSP1 Type *PSP1* may be a user defined name	Running segment type for profiled setpoint 1	Step Dwell Ramp		R/O - shown in Ramp Rate prog.
PSP1	Working setpoint for profiled setpoint 1	Display range [1]		L1. Alterable in Hold
PSP1 Target	Running segment target for profiled setpoint 1	Display range [1]		L1. Alterable in Hold
PSP1 Dwell Tm	Time remaining in running segment for profiled SP 1	Display range		L1. Alterable in Hold
PSP1 Rate	Running segment rate for profiled setpoint 1	Display range [1]		L1. Not in Time To Target prog
PSP1 HBk Appl	Holdback applied for profiled setpoint 1	No Yes		R/O - shown if configured

1. Range limited by user defined upper and lower limits

This table is repeated for *PSP2* parameters and *PSP3* parameters

4.9. TO CREATE A NEW OR EDIT AN EXISTING PROGRAM

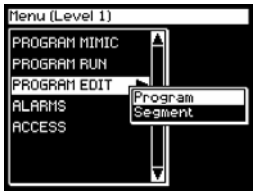
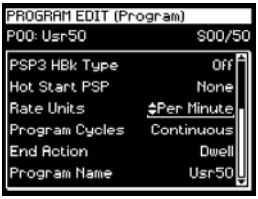
To create or edit a program it is first necessary to define the parameters associated with the overall program. These parameters include parameters such as 'Holdback Mode' and 'Rate Units' and will be found under the page header **'PROGRAM EDIT (Program)',** see section 4.9.3.

Then set up the parameters which define each individual segment. These parameters will be found in the page **'PROGRAM EDIT (Segments)',** see section 4.9.5.

4.9.1. Fine and Coarse Holdback

Fine and Coarse Holdback values are only displayed when 'Holdback Mode' = 'Per Segment'. They allow you to apply one value of holdback to selected segments and another value to other segments. For example, you could apply 'Fine Holdback' to one or more Dwell segments and 'Coarse Holback' to one or more Ramp segments
The segments in which Fine and Coarse Holdback are applied are selected in **'PROGRAM EDIT (Segments)'**.

4.9.2. Example: To Create or Edit Program 1

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [ ] to access the page header menu. 2. Press [▲] or [▼] to select '**PROGRAM EDIT**'		
3. Press [ ] to show sub-headers 4. Press [▲] or [▼] (if necessary) to select **'Program'**		This page allows the overall programmer parameters to be defined
5. Press [ ] to show parameters 6. Press [ ] again to select **'Program Number'** 7. Press [▲] or [▼] (if necessary) to select **'1'**		The value of a parameter prefixed by ⇕ can be changed using [▲] or [▼] The view shown in this example shows 'Holdback Mode' = 'Per Segment', This reveals 'CoarseHBk' and 'FineHBk' as described in section 4.9.1.
8. Further parameters can be selected and changed by scrolling to the parameter using [ ] and changing its value using [▲] or [▼]		The view here shows how to set the **'Rate Units'** to **'Minutes'** The full list of parameters is shown in the following table ⇓

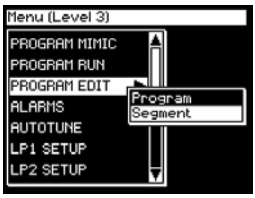
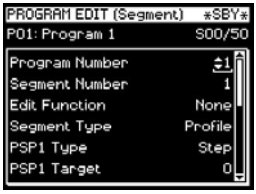
The values of Fine and Coarse Holdback are selected in PROGRAM EDIT/Program.

4.9.3. PROGRAM EDIT (Program Page) Parameters

Table Number: 4.9.3	These parameters affect the overall program.		PROGRAM EDIT (Program Page)	
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
Program Number	Selects the program number to be edited. If 'Profile Lock' ≠ 'Unlocked', only those programs which were created prior to setting the 'Profile Lock' parameter can be selected.	1 to 20 or 1 to 60	1	L1
Edit Function	Allows a program to be copied. The example in section 4.14 describes how this feature is used	None Copy Program Paste Program	None	L1
Hbk Mode	Holdback mode None = no holdback Per prog = applied over the whole program Per seg = active in every segment	None Per Program Per Segment	None	L1
PSP1 HBk Type	Holdback type for *PSP1* (per program) These are deviations between SP and PV Fine and course holdback allows two levels of holdback to be applied to different segments, see also 4.9.1.	Off Fine Lo Fine Hi Fine Band Course Lo Course Hi Course Band	Off	L1 Only displayed if Per Program configured
PSP1 FineHbk	Fine holdback value for *PSP1*	Display Range	0	L1. Only shown if HBk Type ≠ Off
PSP1 CourseHbk	Course holdback value for *PSP1*	Display Range	0	
The above three parameters are repeated for *PSP2* and for *PSP3* if these are configured				
Hot Start PSP	Allows hot start to be applied to each PSP. See also section 4.2.5	None *PSP1* *PSP2*	None	L1

		PSP3		
Rate Units	Rate units for a Ramp Rate Programmer	Per Second Per Minute Per Hour		L1. Only displayed if the programmer is Ramp Rate
Program Cycles	The number of times a program repeats.	Cont. to 999	Cont.	L1
End Action	Defines the action in the end segment. Dwell - the program will dwell indefinitely at the conditions set in the end segment. Reset - the program will reset to the start conditions.	 Dwell Reset		L1
Program Name	Allows a user defined name to be given to the program number	User string Each character can be set in turn		L1

4.9.4. Example: To Set Up Each Segment of a Program

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [D] to access the page header menu. 2. Press [▲] or [▼] to select '**PROGRAM EDIT**'		
3. Press [↵] to show sub-headers 4. Press [▲] or [▼] to select **'Segment'**		If the program is new, confirm as instructed on the display →
5. Press [↵] to select the segment parameters 6. Press [▲] or [▼] to scroll up or down the list of parameters. 7. Press [↵] again to edit the parameter. The value or state of a parameter prefixed by ⬍ can be changed using [▲] or [▼]	If the program exists, the segment details are displayed 	Create Prg: 2? [D]→Cancel [↵]→OK Up to 100 segments are available per program

A back and forward scroll is available by holding down [↵] and pressing [▲] or [▼] respectively

Further parameters may be accessed and adjusted in the same way. These are listed together with an explanation of their function in the following table

4.9.5. PROGRAM EDIT (Segment) Parameters

Table Number: 4.9.5	These parameters allow you to set up each segment in the program		PROGRAM EDIT (Segment)	
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
Program Number	Selects the program number to be edited	1 to 20 (or 60)		L1
Segment Number	Selects the segment number to be edited	1 to 100		L1
Edit Function	Allows a segment to be inserted The example in section 4.15 describes how this feature is used	None Insert Segment Delete Segment	None	L1
Segment Type	Segment type	Profile End Segment Go Back	Profile	L1
Profile = a normal segment End Segment = the last segment in the program (press ↵ to confirm) Go Back = repeat part of program. Not shown for segment 1.				
PSP1 Type	Profile setpoint 1 type	Step Dwell Ramp		L1.
Only shown if Program Type = Ramp Rate and program not in End				
PSP1 Target	Profile setpoint 1 target value	SP1 lo limit to SP1 hi limit	0	L1
PSP1 Dwell Tm	Profile setpoint 1 dwell time	d : h : m : s		L1.
Only shown if Program Type =Ramp Rate; Segment Type = Dwell and program not in End				
PSP1 Rate	Profile setpoint 1 rate			L1
Only shown if Program Type =Ramp Rate; Segment Type = Dwell and program not in End				
PSP1 Hbk Type	Profile setpoint 1 holdback type	Off Fine Lo Fine Hi Fine Band Course Lo Course Hi Course Band	Off	L1
Only shown if holdback is configured per segment				
The above five parameters are repeated if *PSP2* and *PSP3* are configured				

Seg Duration	Duration for Time to Target programmer only	d : h : m : s		L1
Wait Event	Wait if selected event is true Only shown if wait events configured	No wait Event A Event B Event C	No Wait	L1
Prog User Val 1	Allows a Programmer User Val to be chosen. User Values are described in the Engineering Handbook. Only shown if Prog User Val 1 is configured	0 to 100	0	L1
Prog User Val 2	Same as Prog User Val1			
Prog DO Values	Sets programmer event outputs on or off. The number of DO values is set by 'Num of Prog DOs' PROGRAM EDIT (Options) Not shown if Num of Prog Dos = 'None'	□□■□ ■ = Off □ = On		L1
Seg Edit 1 (to 16)	If programmer event outputs have been configured, then, as an alternative to the previous presentation, the event can be given a name. [PROGRAM EDIT (Options) – Named Dos? = Yes]	The name of the event is shown with its state On or Off	Off	L1
GoBack to Seg	Allows repeat segments to be set up within a profile. Go back defines the point in the program where the repeat segments are entered. Only shown if segment. type is Go Back	1 to no. of segments See also Section 4.4.2		L1
Go Back Cycles	Sets up the number of times the segments are repeated Only shown if segment. type is Go Back	1 to 999	1	L1
Segment Name	Allows a user defined name to be chosen	Default Text to 100:Usr 100	Default Text	L1

4.10. ASYNCHRONOUS PROGRAMMER

The asynchronous programmer is described in section 4.1.2.
A summary of the functions available in the asynchronous programmer is given below:-

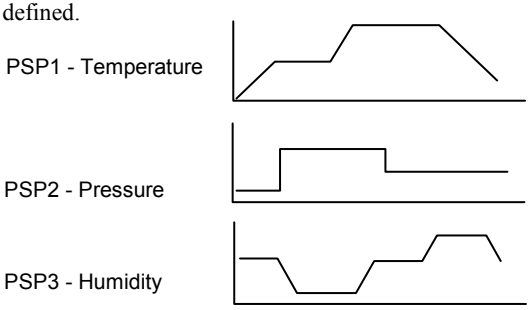
- Creation of programs is the same as for the synchronous programmer, thus allowing for a different number of segments for each PSP.
- The number of available programs for each PSP is fixed at 20
- Twenty Program Groups are available. Program Groups are described in section 4.11
- Up to three programs may be configured into each program group
- Programs in each Program group are executed asynchronously. They may all start at the same time although PSP1, PSP2 or PSP3 may be run, held or reset independently.
- Each program can have up to 16 event outputs and two user values per segment
- The first press of the PROG button allows the user to select the program group to run
- The user may select and modify programs in the selected group when the program is in Hold or Reset mode in the same way as a synchronous programmer
- Changes made to programs, other than Group 0, are permanent
- A delayed start parameter is available
- Changes made to Program Group 0 will be overwritten by stored program combinations for other groups when one of these is selected
- The Run/Hold button acts as a global Program Group control, i.e. all programs in the program group are put into the requested state
- Individual status parameters are available for each program in the group
- There is a Group Status parameter to control the state of the active run group
- Three programmer blocks are utilised to service each Program Group
- Programs not running as part of an active group may be run under independent control, provided the programmer block is not already in use by the active Program Group

4.11. PROGRAM GROUPS

Up to three PSPs can be programmed into a single Program Group.

Example 1: Run Group 1

You may wish to run a Temperature program, a Pressure program and a Humidity program in a particular application. These are shown below as PSP1, PSP2 and PSP3 respectively. Each PSP program can store up to 20 profiles and each includes 16 event outputs. Any combination of these can be placed into a program group. Up to 20 program groups can be defined.



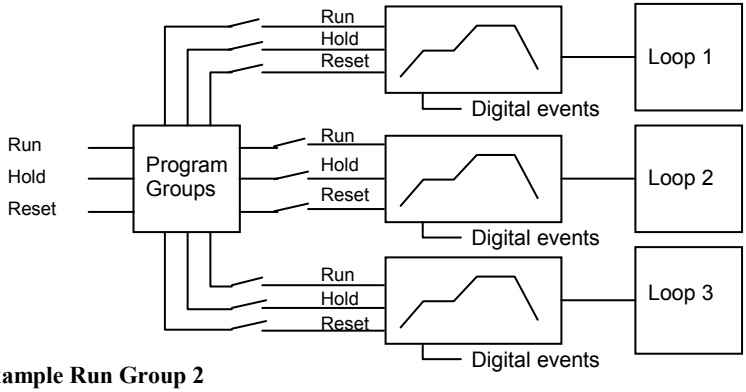
PSP1 is allocated to the first 20 program numbers - default names PSP1:01 to 20

PSP2 to the next 20 - default names PSP2:01 to 20

PSP2 to the last 20 - default names PSP3:01 to 20

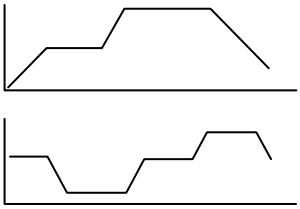
This is applicable over digital communications

Each program can be run, held or reset individually or together as a group.



Example Run Group 2

This might consist of a Temperature Profile and a Humidity profile



Up to 20 profiles can be stored in each PSP

4.11.1. PROGRAM GROUPS Group Edit Page

This page is available in operator and configuration level.

Table Number: 4.11.1.	These parameters allow you to set up individual Program Groups		PROGRAM GROUPS (Group Edit Page)	
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
Group Number	To select the Group number Load Programs allows a program to be entered and run directly	'Load Programs' or select from 1 to 20	Load Programs	L1
Delayed Start	To set a time delay before the program will run	h:mm:ss	0:00:00	L3
Group Status	The program group can be controlled from this parameter The status of the program is also shown by text and symbols at the top of this display	Reset Run Hold Complete		L1
PSP1	To select the profile to be run in the group. Not Used means PSP1 is not part of the group 01:PSP1:P1 means PSP1 is selected from program 1 to 20	Not Used 01:PSP1:P1 to 20:PSP1;P20		L1
PSP2	As above			L1
PSP3	As above			L1
Group Name	A user configurable name By default if Group Number = Load Programs then Group Name = USER SELECT. To customise the name press △ or ▽ to change the digit with the flashing cursor. Press ↻ to advance the cursor	USER SELECT Group 1 to 20	GROUP NAME	L1
Group Run	Group Run	Off On	R/O	L3 R/O
Group Hold	Group Hold	Off On	R/O	L3 R/O
Group Reset	Group Reset	Off On	R/O	L3 R/O
Group End	Group End	Off On	R/O	L3 R/O

4.12. PROFILE SETPOINT PAGES

These pages are similar to the PROGRAM EDIT page available in the synchronous programmer. They allow you to set up each PSP.

There are four pages:-

1. The Run General page available in Operator Level 1. Provides running information of the PSP
2. The Run Segment page available in Operator Level 1. Provides running information of each segment of the PSP
3. The Program Edit page available in Operator Level 1. Allows editing of the overall PSP
4. The Segment Edit page available in Operator Level 1. Allows editing of each segment in the PSP

4.12.1. PSP1 (2 OR 3) PROFILE Run General Pages

This page is similar to the 'PROGRAM RUN' page for the synchronous programmer and provides information on the running program.

Table Number: 4.12.1	**These parameters p**rovide running information of the PSP This page is available in operator and configuration level		**PSP1 (2 or 3) PROFILE (Run General)**	
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
Program	Number of the running program	*PSP1:01* to *PSP1:20* Or name from user text	PSP1:01	L3
Prog DOs	Digital outputs summary (Up to 16) These are shown in this format if 'Named Dos' = 'No'	□□■□ ■ = Off □ = On		L3
Prog DO 1 (to 16)	If programmer event outputs have been configured, then, as an alternative to the previous presentation the event can be given a name. [PROGRAM EDIT (Options) – Named Dos? = Yes]	The name of the event is shown with its state On or Off	Off	L3
Time Remaining	Time remaining to end of program (up to 24 hrs)	Not Running or h:mm:ss		L3
Days Remaining	Number of days left for the programmer to run	0 to 255		L3

Fast Run	Allows the program to fast run	No Yes	No	L3. Alterable in reset or complete
Delayed Start	Delay before the start of the program	h:mm:ss	0:00:00.0	L3
Program Status	Controls the program when not part of a group	Reset Run Hold Complete		L1
Prog Time Elap	Program time elapsed (up to 24 Hrs)	h: mm: ss		L3 R/O
Prog Cycle Rem	Remaining number of cycles	1 to 999		L1 R/O Alterable in Hold (only shown if 'Prog Cycles' > 0)
Total Segments	Number of segments in the running program	0 to 100		L1 Alterable in Hold
Segment Number	The currently running segment number	1 to 100		L1 R/O
Segment Type	Running program segment type Profile = normal segment End Segment = End of prog Go Back =repeat part of prog	Profile End Segment Go Back	Profile	L1 R/O
Segment Name	A user defined name for the segment		Default Text	L1 R/O
Seg Time Rem	Time remaining in the current segment	d: h: m: s		L1 R/O Alterable if Time To Target prog and in Hold
Wait Status	Wait Status	No Wait Event A Event B Event C	No Wait	L1 R/O
Wait Condition	Wait condition for the running segment	No Wait Event A Event B Event C	No Wait	L1 Alterable in Hold

Prog User Val 1	Active Programmer User Val 1. Name is user configurable			L1
Prog User Val 2	Active Programmer User Val 2. Name is user configurable			L1
GoBack Rem	Number of repeat cycles remaining	1 to 999		L1 Alterable in Hold
End Action	The state required in the end segment	Dwell Reset		L1 R/O
Prog Reset DO	These are the digital events in Reset and are shown in this format if 'Named Dos' = 'No' The number of DO values is set by 'Num of Prog DOs' PROGRAM EDIT (Options) Not shown if Num of Prog Dos = 'None'	□□■□ (up to 16) ■ = Off □ = On		Only shown if configured. Alterable in Reset
Prog DO 1 (to 16)	If programmer event outputs have been configured, then, as an alternative to the previous presentation, the event can be given a name. [PROGRAM EDIT (Options) – Named Dos? = Yes]	The name of the event is shown with its state On or Off	Off	L1
Reset *UsrVal1*	Reset prog user 1 values. Name is user configurable			L1
Reset *UsrVal1*	Reset prog user 1 values. Name is user configurable			L1

4.12.2. PSP1 (2 OR 3) PROFILE Run Segment Pages

Table Number: 4.12.2	These parameters show the running conditions in each segment of the running program			PSP1 (2 or 3) PROFILE (Run Segment Page)
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
Seg Time Rem	Segment time remaining	h: m: s		L1
PSP1 Type	PSP1 type Name is user configurable	Step Dwell Ramp		L1
PSP1	Working setpoint for profiled setpoint 1. Name is user configurable	Display range Note 1		L1. Alterable in Hold
PSP1 Target	Running segment target for profiled setpoint 1. Name is user configurable	Display range Note 1		L1. Alterable in Hold
PSP1 Dwell Time	Remaining dwell time for PSP1	h: m: s		L1. Alterable in Hold
PSP1 Rate	PSP1 ramp rate			L1
PSP1 HBk Appl	PSP1 holdback applied	No Yes		L1

Note 1:- Range limited by user defined upper and lower limits. If HHHHH or LLLLL appear this indicates out of range high or low respectively.

4.12.3. PSP1 (2 OR 3) PROFILE Program Edit Parameters

This page is similar to the PROGRAM EDIT (Program Page) in the synchronous programmer

Table Number: 4.12.3	These parameters set up the overall program.		PSP1 (2 or 3) PROFILE (Program Edit)	
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
Program Number	Selects the program number to be edited. If 'Profile Lock' ≠ 'Unlocked', only those programs which were created prior to setting the 'Profile Lock' parameter can be selected.	*PSP1:01* to *PSP20:20* Or name from user text	PSP1:01	L1
Edit Function	Allows a program to be copied and pasted. The example in section 4.14 describes how this feature is used	None Copy Program Paste Program	None	L1
Hbk Mode	Holdback mode None = no holdback Per prog = applied over the whole program Per seg = active in every segment	None Per Program Per Segment	None	L1
PSP1 HBk Type	Holdback type for *PSP1* (per program) These are deviations between SP and PV Fine and course holdback allows two levels of holdback to be applied to different segments.	Off Fine Lo Fine Hi Fine Band Course Lo Course Hi Course Band	Off	L1 Only displayed if Per Program configured
PSP1 FineHBk	Fine holdback value for *PSP1*	Display Range	0	L1. Only shown if HBk Type ≠ Off
PSP1 CourseHBk	Course holdback value for *PSP1*	Display Range	0	
Rate Units	Rate units Only if program Type = Ramp Rate	Per Second Per Minute Per Hour		L1

	(PROGRAM GROUPS 0ptions Page)			
Hot Start	Allows hot start to be applied. Only appears if Hot Start = Yes (PROFILE SP1 Options Page)	Disabled Enabled	None	L1
Program Cycles	The number of times a program repeats.	Cont. to 999	Cont.	L1
End Action	Defines the action in the end segment. Dwell - the program will dwell indefinitely at the conditions set in the end segment. Reset - the program will reset to the start conditions.	 Dwell Reset		L1
Program Name	Allows a user defined name to be given to the program number	User string Each character can be set in turn		L1

4.12.4. PSP1 (2 or 3) PROFILE Segment Parameters

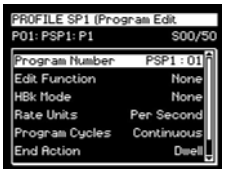
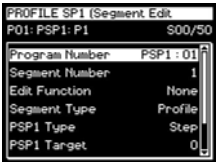
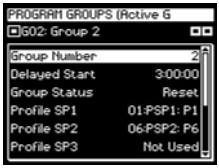
This page is similar to the PROGRAM EDIT (Segment Page) in the synchronous programmer

Table Number: 4.12.4.	These parameters allow you to set up each segment in the program		PSP1 (2 or 3) PROFILE (Segment Edit)	
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
Program	Selects the program number to be edited	*PSP1:01* to *PSP1:20* Or from user text	PSP1:01	L1
Segment Number	Selects the segment number to be edited	1 to 100		L1
Edit Function	Allows a segment to be inserted The example in section 4.15. describes how this feature is used	None Insert Segment Delete Segment	None	L1
Segment Type	Segment type	Profile End Segment Go Back	Profile	L1
Profile = a normal segment End Segment = the last segment in the program (press ↻ to confirm) Go Back = repeat part of program. Not shown for segment 1.				
PSP1 Type	Profile setpoint 1 type	Step Dwell Ramp		L1
Only shown if Program Type = Ramp Rate and program not in End				
PSP1 Target	Profile setpoint 1 target value	SP1 lo limit to SP1 hi limit	0	L1
PSP1 Dwell Tm	Profile setpoint 1 dwell time	d : h : m : s	0:00:00.0	L1
Only shown if Program Type =Ramp Rate; Segment Type = Dwell and program not in End				
PSP1 Rate	Profile setpoint 1 rate			L1
Only shown if Program Type =Ramp Rate; Segment Type = Dwell and program not in End				
PSP1 Hbk Type	Profile setpoint 1 holdback type Only shown if holdback is configured per segment	Off Fine Lo Fine Hi Fine Band Course Lo Course Hi Course Band	Off	L1

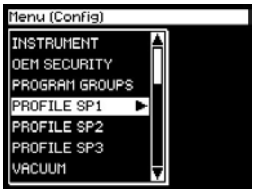
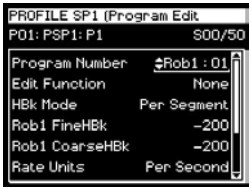
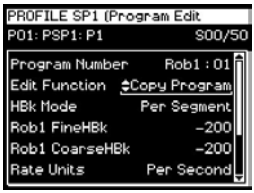
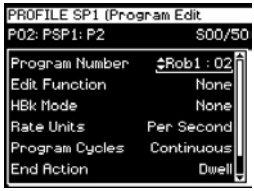
Seg Duration	Segment duration for Time to Target programmer only	d : h : m : s	0:00:00.0	L1
Wait Event	Wait if selected event is true Only shown if wait events configured	No wait Event A Event B Event C	No Wait	L1
Prog User Val 1	Allows a Programmer User Val to be chosen. User Values are described in the Engineering Handbook. Only shown if Prog User Val 1 is configured	0 to 100	0	L1
Prog User Val 2	Allows a Programmer User Val to be chosen. User Values are described in the Engineering Handbook. Only shown if Prog User Val 2 is configured	0 to 100	0	L1
Prog DO Values	Digital outputs summary These are shown in this format if 'Named Dos' = 'No' The number of DO values is set by 'Num of Prog DOs' PROFILE SP1 (Options) Not shown if Num of Prog Dos = 'None'	□□■□ (Up to 16) ■ = Off □ = On		L1
Seg Edit 1 (to 16)	If programmer event outputs have been configured, then, as an alternative to the previous presentation the event can be given a name. [PROGRAM EDIT (Options) – Named Dos? = Yes]	The name of the event is shown with its state On or Off	Off	L1
GoBack to Seg	Allows repeat segments to be set up within a profile. Go back defines the point in the program where the repeat segments are entered.	1 to no. of segments See also Section 4.4.2		L1
Go Back Cycles	Sets up the number of times the segments are repeated	1 to 999	1	L1
The above two parameters are only shown if segment type is Go Back				
Segment Name	Allows a user defined name to be chosen	Default Text to 50:Usr 50	Default Text	L1

4.13. Example: TO SET UP AND RUN PROGRAM GROUPS

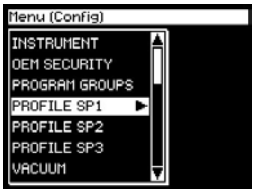
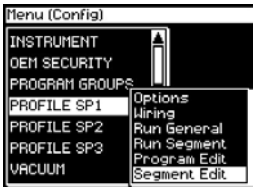
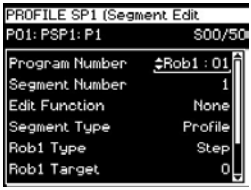
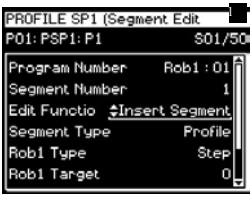
Using the two examples from section 4.11 and the general navigation procedures:-

Do This	This Is The Display You Should See	Additional Notes
1. Set up a temperature program in PSP1:01		See section 4.12 for the full list of parameters Set each parameter to suit your application
2. Set up each segment in the program		See Table 4.12 for the full list of parameters Set each parameter to suit your application
3. Set up a pressure and Humidity program in PSP2:01 and PSP3:01		These are the same as Example 1 shown in section 4.11
4. Set up further programs as required in PSP1:02 (to 20), PSP2:02 (to 20), and PSP3:02 (to 20)		These are the same as Example 2 shown in section 4.11
5. When all PSPs have been set up, place them in Groups		
6. Repeat for futher groups		In this example a delayed start of 3 hours has been placed on Group 2 which will run two profiles PSP1:P1 and PSP2:P6
7. To run the program press PROG This is also described in section 4.16		Select the group to run. Press PROG again to run the selected group

4.14. Example: TO COPY A PROGRAM

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [page] to access the page header menu. 2. Press [▲] or [▼] to select '**PROFILE SP1**'		
3. Press [↵] to select sub-headers 4. Press [▲] or [▼] to select **'Program Edit'**		
5. Press [↵] to select parameters and again to edit **'Program Number'** 6. Press [▲] or [▼] to select the program number to be copied		In this case the program has been given a name by the user
7. Press [↵] to scroll to **'Edit Function'** 8. Press [▲] or [▼] to **'Copy Program**		When the program is copied the display returns to 'None'
9. Press [↵] and [▲] to scroll back to **'Program Number'** 10. Press [▲] or [▼] to select the program to paste to – in this case program 2		
11. Press [↵] again to scroll to **'Edit Function'** 12. Press [▲] or [▼] to **'Paste Program**		Press [↵] or [page] to confirm or cancel. If no button is pressed for 10 seconds the display reverts to previous and the paste is cancelled.

4.15. Example: TO INSERT A SEGMENT INTO A PROGRAM

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [page] to access the page header menu. 2. Press [▲] or [▼] to select '**PROFILE SP1'**		
3. Press [↵] to select sub-headers 4. Press [▲] or [▼] to select **'Segment Edit'**		
5. Press [↵] to select parameters and press again to edit **'Program Number'** 6. Press [▲] or [▼] to select the program number to be edited		In this case the program has been given a name by the user
7. Press [▲] or [▼] to scroll to **'Edit Function'** 8. Press [▲] or [▼] to **'Insert Segment'** 9. Press [↵] to confirm or [page] to cancel	 	In this case segment 1 is inserted and the total segment count increases by one If no button is pressed for 10 seconds the display reverts to previous.
		If all segments in the program are already configured the message 'Program Full' is shown

4.16. PROGRAMMER ERROR MESSAGES

If an invalid entry is made when setting up programs through the front panel, a pop up error message will appear. For example a pop up will occur if an attempt is made to copy and paste a program which has more segments than the controller has left. The messages are similar to those which are shown if the same action is implemented over digital communications – these messages are further described in section 18.3 of the Engineering handbook part no. HA026933.

4.17. RUNNING AN ASYNCHRONOUS PROGRAMMER

As with the synchronous programmer the group of programs can be run using:-

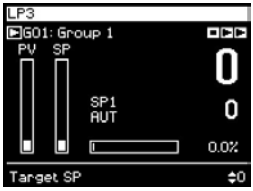
1. The 'PROG' button.
2. A digital input configured to activate all configured PSPs
3. Digital inputs configured to run each PSP separately
4. Via a command from digital communications

If the PROG button is used (as described in the following section), a pop-up window is shown which allows you to choose the format of the program. The other methods listed above are designed for remote or fixed operation in which case the pop-up window is not displayed.

The program may also be controlled using the relevant parameters in the lists. These are:-

5. 'Group Status' in the PROGRAM GROUPS Active Group list. This allows all configured PSPs to be started together
6. 'Program Status' in the PSP1 (2 or 3) PROFILE Run General list. This allows each PSP to be run separately.

4.17.1. Example: To Run a Program Using the PROG Button

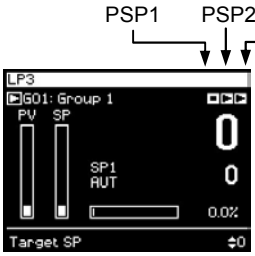
Do This	This Is The Display You Should See	Additional Notes
1. From any display Press PROG		The Run Group Status pop-up will be shown. The following conditions may be selected:- Group to run: Group 1 to Group 20 or USER SELECT (Press △ or ▽ to choose) Group 1 to 20 selects pre-set profiles as set up in PROGRAM GROUPS Active Group page. If the user changes the profiles in this pop-up display the changes become permanent. USER SELECT will choose the last selected Program Group but if the profiles are changed they are only applicable to the current run
2. Press PROG again to **Run** the program		(Press ↻ to scroll down the list)
3. Press PROG again to **Hold** the program 4. Press PROG and hold for 3 seconds to **Reset** the program		Profile SP1: Not Used or 01:*PSP1:P1* to 20:*PSP1:20* Not Used means that the profile will not be run in this program 01:PSP1:P1 will select PSP1 Program 1 to PSP1 Program 20 Profile SP2: Not Used or 01:*PSP2:P1* to 20:*PSP2:20* Profile SP3: Not Used or 01:*PSP3:P1* to 20:*PSP3:20*
This is an example of an Overview display Note the symbols shown on each of these displays as described in the following section		Delayed Start: This can be set between 0:00:00 and 500:00:0 hrs. This value counts down when Run is selected. In the event of a power fail, delayed start retains its value prior to the power fail, but the request to run is cancelled.

A running program may be interrogated and changes made to segments in the same way as a synchronous programmer.
The programmer mimic can also be displayed in the same way as a synchronous programmer

4.17.2. Asynchronous Programmer Status Bar

The programmer status bar is shown in the top right hand corner of the loop overview displays (as selected by the LOOP button).

They are shown as



The view shown here is applicable when Groups are used. The number of displayed status symbols depends on the number of programmer blocks used, but the order of display is always left to right – with no gaps.
When Groups are not used the program status is associated with the individual loop pages.

Symbols Used

The current status is shown in inverse, e.g. PSP is in Hold

These symbols are also used on other views, for example, the Run Group Status pop-up shown in the previous section.

5. CHAPTER 5 ALARM OPERATION 2

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5. Chapter 5 ALARM OPERATION

5.1. DEFINITION OF ALARMS AND EVENTS

Alarms are used to alert an operator when a pre-set level has been exceeded. They are normally used to switch an output – usually a relay – to provide external actions to the process.

Soft Alarms are indication only and do not operate an output.

Events are generally defined as conditions, which occur as part of the operation of the plant. They do not require operator intervention and, therefore, do not cause an alarm message to be displayed. They can be attached to operate an output (relay) in the same way as an alarm.

5.1.1. Customisable Parameter Names

Throughout this chapter parameter names shown in *italics* are customisable by the user when in configuration access level. The name of the parameter may vary, therefore, from instrument to instrument.

Typical customisable parameter names are:

- Alarm names
- Loop names
- Module and input names
- Custom units
- Promoted parameters

5.2. TYPES OF ALARM USED IN 2704 CONTROLLER

This section shows graphically the operation of different types of alarm used in the controller. The graphs show changes in PV plotted against time.

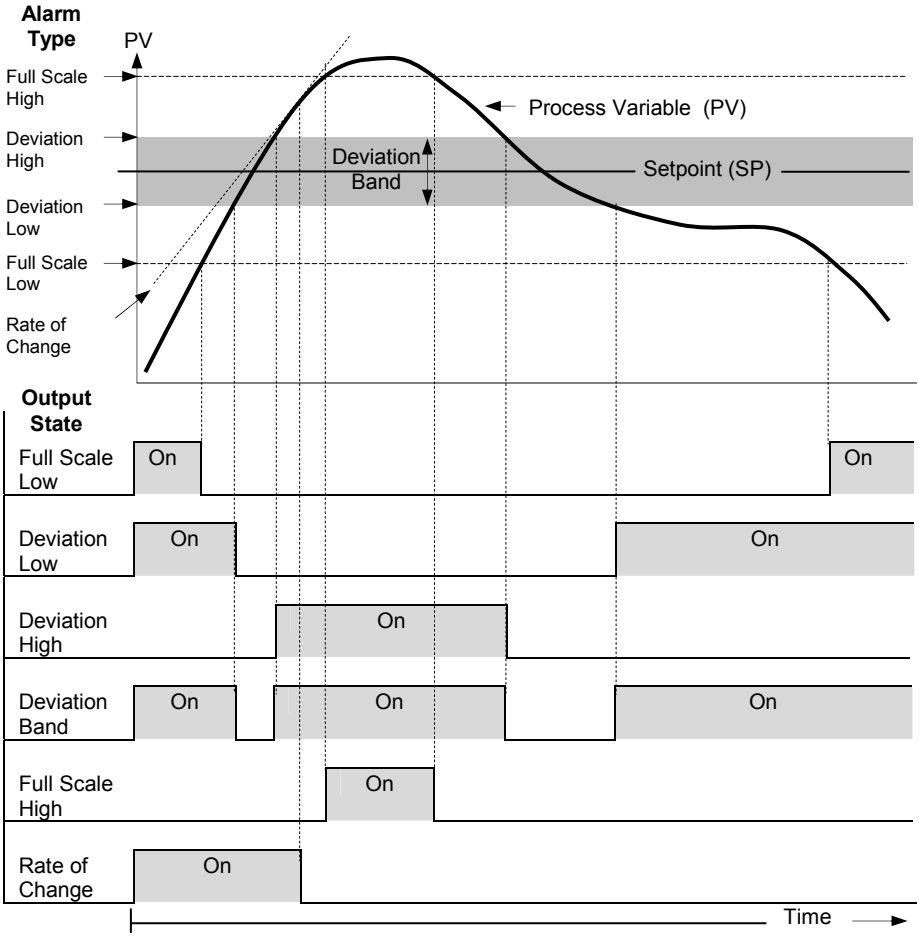


Figure 5-1: Types of Alarm

Rate of change alarms detect if the rate of change in PV, set as units per minute or per second, exceeds the setpoint value. An alarm setpoint set + will detect positive rates of change. An alarm setpoint set - will detect negative rates of change. Therefore, if it is required to measure the rate of change in both directions then two alarms must have been configured. Since rate of change alarms are calculated over a period of time a small delay may be apparent before the alarm is indicated. This is generally only noticeable if the PV changes very quickly.

Deviation Alarms. The setpoint used for deviation alarms is normally derived as a remote input from another device - for example, a temperature controller. The setpoint can also be internally set within the controller - in this case called the local setpoint value.

Blocking Alarms only occur after the start up phase when the alarm has first entered a safe state. The alarm is only indicated the next time it is active. It is used, for example, to ignore start up conditions which are not representative of running conditions.

Hysteresis is the difference between the point at which the alarm switches ON and the point at which it switches OFF.
It is used to prevent relay chatter.

Delay a settable time between an alarm occurring and it being displayed on the indicator

Latching Alarms The alarm is indicated until it is acknowledged by the user. Acknowledgement of an alarm can be through the controller front buttons, from an external source using a digital input to the controller or through digital communications.

There are two ways that the alarm can be acknowledged:

1. **Automatic Reset.** The alarm continues to be active until both the alarm condition is removed AND the alarm is acknowledged. The acknowledgement can occur **BEFORE** the alarm condition is removed.
2. **Manual Reset.** The alarm continues to be active until both the alarm condition is removed AND the alarm is acknowledged. The acknowledgement can only occur **AFTER** the alarm condition is removed.

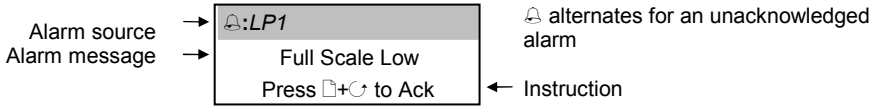
5.2.1. Grouped Alarms

Alarms can be associated with different aspects of the process. They are grouped in accordance with the functions they perform as follows:

Loop Alarms	Alarms associated with each control loop. Examples are: High, Low, Deviation and Rate of Change. Two alarms are available for each loop. On a new controller these are the only alarms which are configured - those listed below must be enabled in configuration level, see 2704 Engineering Handbook HA026933.
PV Input Alarms	Alarms which operate on the PV input. Examples are: High and Low. Two alarms are available with this input.
Analogue Input Alarms	Alarms which operate on the analogue input. Examples are: High and Low. Two alarms are available with this input.
Module Alarms	Alarms which operate on each plug in module. These can be input or output alarms depending upon the function of the module fitted. These alarms are associated with modules 1, 3, 4, 5, & 6, since module 2 is reserved as a an extra memory module
User Alarms	Eight undedicated alarms which can be wired to any variable.

5.3. HOW ALARMS ARE INDICATED

When an alarm occurs a message will appear on the display which will indicate the source and the type of alarm. The format of this alarm message is:



When the alarm has been acknowledged the message shown in the banner of the pop up window above will now be shown in the Loop Display page.
The symbol will be shown steady in the top banner of any page if any alarm is still present.

If a relay has been connected to the output of the alarm, it will operate to allow an external beacon or audible device to be activated.
Events will not cause either a message or the beacon to be illuminated.

5.3.1. To Acknowledge an Alarm

Press +↻ as instructed.
The action which follows depends upon the type of alarm configured.

If the alarm is non latching	Any relay connected to the alarm output will be reset The red alarm beacon will illuminate permanently if the alarm condition still exists The red alarm beacon will extinguish as soon as the alarm condition no longer exists
Alarm is latching – 'Auto'	Any relay connected to the alarm output will remain set if the alarm condition still exists The red alarm beacon will illuminate permanently if the alarm condition still exists As soon as the alarm condition is no longer present the alarm beacon will extinguish and any relay will be reset
Alarm is latching – 'Manual'	Any relay connected to the alarm output will remain set if the alarm condition still exists The red alarm beacon will illuminate permanently if the alarm condition still exists The alarm indication and any relay connected to it must now be reset. This may be done as described in section 5.4 'The Alarm Summary Page', or by choosing the appropriate Alarm Page, select '*Alarm* Ack' - set to 'Yes', Press ↻ as instructed.

This section describes the usual method to acknowledge an alarm. Section 5.5 describes alternative ways.

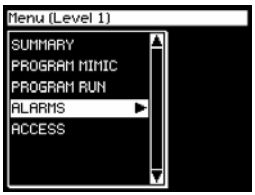
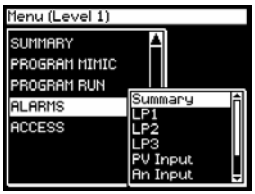
5.3.2. Alarm Delay Time

A delay time may have been set for each alarm between the occurrence of the alarm and the indication of the alarm in the controller. This is useful to prevent spurious alarms from being indicated in some noisy or rapidly changing processes.
To set delay time the controller must be placed in Configuration level. This is described in the 2704 Engineering Handbook Part No HA026933.

If you notice a delay between an alarm occurring and it being indicated by the controller then a delay may have been set in configuration level.

5.4. THE ALARM SUMMARY PAGE

The status of alarms is displayed in the Alarm Summary page. To inspect the status:

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [page] as many times as necessary to access the page header menu 2. Press [▲] or [▼] to select **'ALARMS'**		
3. Press [↵] to display sub-headers		The first sub-header is Summary. Further sub-headers only appear if the alarms have been configured.
4. Press [↵] to display a **'Summary'** of alarm parameters 5. Press [▲] or [▼] to scroll down the list of alarm messages.		The alarm message will alternate between the source of the alarm and the type of alarm. It can be acknowledged from either view. For a non-latched alarm, the message will disappear when the alarm is no longer present. For a latched alarm, the message will remain until the alarm condition is removed. See also section 5.5. Parameters shown ⬍ can be adjusted. For example, the alarm acknowledge parameter = 'No' or 'Yes'

The full list of parameters is shown in the following table

5.4.1. Alarms (Summary) Parameters

Table Number: 5.4.1	These parameters indicate alarm status		ALARMS (Summary Page)	
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
New Alarm	Only available over digital communications to flag that a new alarm has occurred	No Yes		L1 R/O
LP1 Ack	Status and acknowledge loop 1 alarms	No Yes		L1
LP2 Ack	Status and acknowledge loop 2 alarms	No Yes		L1
LP3 Ack	Status and acknowledge loop 3 alarms	No Yes		L1
PV Input Ack	Status and acknowledge PV input alarms	No Yes		L1
An Input Ack	Status and acknowledge analogue input alarms	No Yes		L1
Module 1 Ack	Status and acknowledge module 1 alarms	No Yes		L1
Module 3 Ack	Status and acknowledge module 3 alarms	No Yes		L1
Module 4 Ack	Status and acknowledge module 4 alarms	No Yes		L1
Module 5 Ack	Status and acknowledge module 5 alarms	No Yes		L1
Module 6 Ack	Status and acknowledge module 6 alarms	No Yes		L1
User 1 Ack	Status and acknowledge User 1alarm	No Yes		L1
to	to			
User 8 Ack	Status and acknowledge User 8 alarm	No Yes		L1
Ack All	Acknowledges all alarms	No Yes		L1

5.5. ALARM ACKNOWLEDGEMENT

A new alarm can be acknowledged in five ways:

1. By pressing and simultaneously
2. Through the alarms 'Summary' page
3. Through the 'Alarms' page
4. From an external source, such as a pushbutton, connected to a suitably configured digital input
5. Through digital communications

The message will remain on the screen and the alarm symbol, 🔔, will continue to flash until the alarm is acknowledged - you are prompted to do this by pressing and simultaneously. The symbol will stop flashing and remain illuminated until all alarm conditions are removed. If a further alarm occurs the symbol will start flashing again and a new alarm message will pop up.

The message displayed indicates the source of the alarm and may be customised to the users terminology. The source will inherit the name of the channel or the loop or the user alarm name.

The operation of the alarm acknowledgement depends whether the alarm is non-latching or latching, auto or manual reset. This is shown in the following tables:-

Non Latched Alarms

Alarm Condition	Acknowledge	Symbol 🔔	Message	Ext relay (if fitted)
ON	No	Flashing	Alarm message	On
Off	No	Off	Former display	Off

Alarm Condition	Acknowledge	Symbol 🔔	Alarm message	Ext relay (if fitted)
ON	No	Flashing	Alarm message	On
On	Yes	Steady	Former display	Off
Off		Off	Former message	Off

Latched Alarm - Auto

Alarm Condition	Acknowledge	Symbol 🔔	Message	Ext relay (if fitted)
ON	No	Flashing	Alarm message	On
Off	No	Flashing	Alarm message	On
Off	Yes			

Alarm Condition	Acknowledge	Symbol 🔔	Message	Ext relay (if fitted)
ON	No	Flashing	Alarm message	On
ON	Yes	Steady	↻:Access Level	Off
Off	-	Off	Normal display	Off

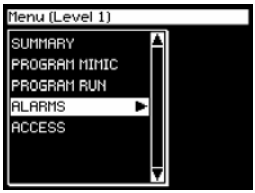
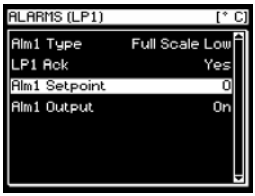
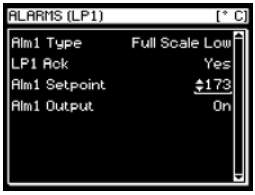
Latched Alarm - Manual

Alarm Condition	Acknowledge	Symbol 🔔	Message	Ext relay (if fitted)
ON	No	Flashing	Alarm message	On
Off	No	Flashing	Alarm message	On
Off	Yes	Off	Access Level	Off

Alarm Condition	Acknowledge	Symbol 🔔	Message	Ext relay (if fitted)
ON	No	Flashing	Alarm message	On
ON	Yes	Steady	Former display	Off
Off	-	Steady	Former display	Off
Off	To acknowledge see below	Off	Former display	Off

5.6. TO SET ALARM TRIP LEVELS

The alarm trip level (setpoint) is available in access level 1 and is adjusted by accessing the page header for the chosen alarm. The following example adjusts these parameters for Alarm 1/Loop 1:

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [ ] as many times as necessary to access the page header menu 2. Press [▲] or [▼] to select **'ALARMS'**		The alarm type must have been selected in config level, otherwise the alarm parameters will not be available
3. Press [ ] to display the list of sub-headers 4. Press [▲] or [▼] to select the source of the alarm, in this example '**LP1'**		
5. Press [ ] to display the list of alarm parameters for LP1 6. Press [▲] or [▼] to scroll to **'Alm1 setpoint'**		Alm1 Type is read only
7. Press [ ] to select the *AL1 Setpoint* 8. Press [▲] or [▼] to adjust the value		This example sets the alarm trip level to 173 units

5.7. ALARM PARAMETERS

The parameter tables listed in this section are only displayed if an alarm has been configured for the particular loop, input or module.

5.7.1. ALARMS (*LP1* Page) Parameters

Table Number: 5.7.1.	These parameters set up the Loop 1 alarms		ALARMS (*LP1*) Page	
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
Alm1 Type	Alarm 1 Type	Off Full Scale Low Full Scale High Deviation Band Deviation High Deviation Low Rate of Change If True If False Goes True Goes False If Changed		R/O
LP1 Ack	Acknowledges alarms on loop 1	No Yes		L1
Alm1 Setpoint	Alarm 1 Setpoint	Controller range		L1
Alm1 Output	Alarm 1 output	Off On	Off	R/O
Alm2 Type	Alarm 2 Type	As Alm1 Type		R/O
Alm2 Setpoint	Alarm 2 Setpoint	Controller range		L1
Alm2 Output	Alarm 2 output	Off On	Off	R/O

The above table is repeated for LP2 and LP3 if these control loops have been configured.

5.7.2. ALARMS (PV Input Page) Parameters

Table Number: 5.7.2.	These parameters set up the alarms associated with the PV input signal.		ALARMS (PV Input Page)	
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
PV Alarm Ack	Alarm acknowledge for PV input	No Yes	No	L1
FS Hi Setpoint	Full Scale High Alarm (1) Setpoint	Controller range		L1
FS Hi Output	Full Scale High alarm (1) output	Off On	Off	R/O
FS Lo Setpoint	Full Scale Low Alarm (2) Setpoint	Controller range		L1
FS Lo Output	Full Scale Low alarm (2) output	Off On	Off	R/O

5.7.3. ALARMS (An Input Page) Parameters

Table Number: 5.7.3.	These parameters set up the alarms associated with the analogue input signal.		ALARMS (An Input Page)	
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
An Alm Ack	Group alarm acknowledge for analogue input	No Yes	No	L1
FS Hi Setpoint	Full Scale High alarm (1) Setpoint	Controller range		L1
FS Hi Output	Full Scale High alarm (1) output	Off On	Off	R/O
FS Lo Setpoint	Full Scale Low Alarm (2) Setpoint	Controller range		L1
FS Lo Output	Full Scale Low alarm (2) output	Off On	Off	R/O

5.7.4. ALARMS (Module 1 Page) Parameters

Table Number: 5.7.4.	These parameters set up the alarms associated with module 1.			ALARMS (Module 1 Page)
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
Module 1 Ack	Group alarm acknowledge for module 1	No Yes	No	L1
FS Hi Setpoint	Full Scale High alarm (1) Setpoint	Controller range		L1
FS Hi Output	Full Scale High alarm (1) output	Off On	Off	R/O
FS Lo Setpoint	Full Scale Low Alarm (3) Setpoint	Controller range		L1
FS Lo Output	Full Scale Low alarm (3) output	Off On	Off	R/O

The above table is repeated for:

Module 3 Module 4 Module 5 Module 6

5.7.5. ALARMS (User 1 Page) Parameters

Table Number: 5.7.5.	These parameters set up user defined alarms.			ALARMS (User 1 Page)
Parameter Name	**Parameter Description**	**Value**	**Default**	**Access Level**
Alm1 Type	Alarm 1 Type	Same as 5.7.1.		R/O
User 1 Ack	Group alarm acknowledge for user alarm 1	No Yes	No	L1
Setpoint	Alarm 1 Setpoint	Controller range		L1
Output	Alarm 1 output	Off On	Off	R/O at L1

The above table is repeated for:

User alarm 2 User alarm 3 User alarm 4 User alarm 5 User alarm 6
User alarm 7 User alarm 8

A. APPENDIX A ORDER CODE 2

A.1. HARDWARE CODE 2

A.2. QUICK START CODE 4

A.3. QUICK START CODE EXAMPLE: 5

A. Appendix A Order Code

A.1. HARDWARE CODE

The 2704 has a modular hardware construction, which accepts up to six plug-in modules and two comms modules. Eight digital IO and a relay form part of the fixed hardware build.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

1	Controller Type
2704	Standard
2704f	Profibus

2	Supply Voltage
VH	85-264Vac
VL	20-29Vac/dc

3	Loops/Programs
First Digit	
1_ _	One Loop
2_ _	Two Loop
3_ _	Three Loop
Second Digit	
_XX	No Programs
_2_	20 Programs (1)
_5_	50 Programs
_A_	Async Programs
Third Digit	
_ XX	No Programs
_ _1	1 Profile
_ _2	2 Profile
_ _3	3 Profile

4	Application
XX	Standard
ZC	Zirconia
V1	1 Gauge Vacuum
V3	3 Gauge Vacuum
BC	Boiler Function

5 - 9	I/O Slots 1 3 4 5 6
XX	None Fitted
R4	Change Over Relay
R2	2 Pin Relay
RR	Dual Relay
T2	Triac
TT	Dual Triac
D4	DC Control
D6	DC Retransmission
PV	PV Input (slots 3 & 6)
TL	Triple Logic Input
TK	Triple Contact Input
TP	Triple Logic Output
MS	24Vdc Transmitter PSU
VU	Potentiometer Input
G3	5Vdc transducer PSU
G5	10Vdc transducer PSU
AM	Analogue input (not in slot 5)
DP	Dual DC (porbe) input (slots 3 & 6)
LO	Isolated single logic OP
DO	Dual 4-20mA OP/24Vdc PSU (slots 1, 4, 5)
HR	Hi resloution DC retrans & 24Vdc PSU (slots 1, 4, 5)
TD	TDS input (7)
PH	4 wire PRT (100Ω)
PL	4 wire PRT (25.5Ω)

10	Memory Module
XX	Not Fitted
MM	Fitted

11 -	Comms H
XX	None Fitted
A2	232 Modbus
Y2	2 wire EIA-485
F2	4 wire EIA-485
AE	232 Bisynch
YE	2 Wire 485 Bisync
FE	4 Wire 485 Bisync
PB	Profibus
DN	DeviceNet
ET	Modbus TCP/Ethernet

12	Comms J
XX	None Fitted
A2	232 Modbus
Y2	2 wire EIA-485
F2	4 wire EIA-485
M1	232 Master
M2	2-wire 485 Master
M3	4-wire 485 Master

13	Manual
ENG	English
FRA	French
GER	German
NED	Dutch
SPA	Spain
SWE	Sweden
ITA	Italian

16	Toolkit Blocks
XX	Standard
U1	Toolkit level 1
U2	Toolkit level 2

17	Tech Support
TS1	1 Hour (default)
TS0	None
TS2	2 Hours
TS4	4 Hours
TS8	8 Hours

18	Config Tools
XX	None

Hardware notes:

1. *Basic controller includes 8 digital registers, 10 user values, 4 timers, 4 totalisers and RT clock*
2. *Toolkit 1 includes 16 analogue, 16 digital, pattern generator, digital programmer, analogue switch, wiring block & 30 user values*
3. *Toolkit 2 includes Toolkit 1 plus extra 16 analogue, 16 digital and 20 user values*
4. *Dual analogue input suitable for one low level and one high level input (inputs not isolated from each other)*
5. *Each channel of the DO module can be 4-20mA control or 24V PSU*
6. *The HR module has 1 high resolution DC output and 1 24Vdc power supply*
7. *PH & PL modules use slots 3 & 6 only. ET module in H slot includes terminal adaptor*

Hardware Code Example

2704/VH/323/XX/RR/PV/D4/TP/PV/XX/A2/XX/ENG/U1/IT

Three loop controller with capability to store 20 three profile programs. Supply voltage 85 - 264 Vac.
Modules: 2 x PV input, 1 x Dual relay, 1 x DC control, 1 x Triple logic output, EIA-232 Comms.
16 analogue and 32 digital operations and iTools supplied with controller.

General Notes

1. Loop 1 PV defaults to main input on microboard. Loop 2 and 3 PV inputs must be fitted in I/O slots 3 or 6 or be assigned to the analogue input.
2. This alarm configuration refers to loop alarms only. One selection per loop is allowed. Additional alarms are available for the user to configure.
3. Thermocouple and RTD inputs assume sensor min and max values with no decimal point.
4. Linear inputs are ranged 0-100%, no decimal point.
5. Temperature inputs will be C unless ordered by USA where F will be supplied.
6. Remote setpoints assume loop min & max ranges.
7. VP1, VP2, VP3 or VP4 not available with override function.
8. For cascade and override inputs only.
9. HR module should be used in feedback mode.

A.2. QUICK START CODE

An instrument delivered to the quick start code is partly configured. For simple applications the this may be sufficient to allow the instrument to be used without further configuration.

1	2	3	4	5	6	7	8	9	10	11	12

1 - 3	Loop function
First Digit	
XXXX	None
S___	Standard PID
C___	Cascade
R___	Ratio
O___	Override [7]
Other Digits	
_PID	PID control
_ONF	On/Off control
_PIF	PID/OnOff control
_VP1	VP w/o feedback
_VP2	VP with feedback
_VP3	Dual VP w/o feedback
_VP4	Dual VP with feedback

4 - 6	PV Inputs
X	None
J	J Thermocouple
K	K Thermocouple
T	T Thermocouple
L	L Thermocouple
N	N Thermocouple
R	R Thermocouple
S	S Thermocouple
B	B Thermocouple
P	P Thermocouple
C	C Thermocouple
Z	RTD/PT100
A	4-20mA linear
Y	0-20mA linear
V	0-10Vdc linear
W	0-5Vdc linear
G	1-5Vdc linear
Custom (Replace C)	
Q	Custom curve
D	D Thermocouple
E	E Thermocouple
1	Ni/Ni18%Mo
2	Pt20%Rh/Pt40%Rh
3	W/W26%Re(Eng)
4	W/W26%Re(Hos)
5	W5%Re/W26%Re(Eng)
6	W5%Re/W26%Re(Hos)
7	Pt10%Rh/Pt40%Rh
8	Exergen K80 IR Pyro

7	Analogue Input
XXX	None
P2_	PV Loop 2
P3_	PV Loop 3
S1_	SP Loop 1
S2_	SP Loop 2
S3_	SP Loop 3
A1_	Aux PV Loop 1
A2_	Aux PV Loop 2
A3_	Aux PV Loop 3
L1_	Ratio lead PV Loop 1
L2_	Ratio lead PV Loop 2
L3_	Ratio lead PV Loop 3
Input range	
Select third digit from table 1	

Table 1	
A	4-20mA linear
Y	0-20mA linear
V	0-10Vdc linear
W	0-5Vdc linear
G	1-5Vdc linear

Precision PV, PH or PL i/p	
_PV	PV input Module
_PA	Aux PV Input [8]
_PL	Ratio lead input
Analogue Input *	
_R_	Setpoint
* For input range select third digit from table 1	
Aux & lead PV inputs *	
_L_	Ratio lead input
_B_	Aux PV input
* For input range select third digit from table 1	
High Res DC Output	
-TA	4-20mA PV retran
-TV	0-10V PV retran
-SA	4-20mA SP retran
-SV	0-10V SP retran

8 - 12	Slot function
Loop number	
XXX	Unconfigured
1__	Loop No 1
2__	Loop No 2
3__	Loop No 3
Single relay or triac	
_HX	Heat
_CX	Cool
Dual relay or triac	
_HC	PID Heat & Cool
_VH	VP Heat
_AA	FSH & FSH
_AB	FSH & FSL
_AC	DH & DL
_AD	FSH & DH
_AE	FSL & DL
_AF	FSH & FSL
_AG	FSH & DB
_AH	FSL & DB
_AJ	DB & DB
HHX	Heat O/P lps 1 & 2
CCX	Cool O/P lps 1 & 2
P12	Prog events 1 & 2
P34	Prog events 3 & 4
P56	Prog events 5 & 6
P78	Prog events 7 & 8
Triple logic output	
_HX	Ch1 Heat
_CX	Ch1 Cool
_HC	Ch1 Heat, Ch2 Cool
HHX	Heat O/P lps 1 & 2
HHH	Heat O/P lps 1,2 & 3
Single DC outputs	
_H_	PID Heat
_C_	PID Cool
_T_	PV Retransmission
_S_	SP Retransmission
For output range select third digit from table 1	
Dual 4-20mA/24Vdc PSU output	
HHX	Heat OP Lps 1 & 2
_HC	Heat Cool
_HT	Ch 1 Heat, Ch 2 Tx
TTX	Both chs Txmtr
Changeover Relay	
_HX	Heat
_CX	Cool
Potentiometer input	
_VF	VP Heat Feedback
_VF	VP Heat Feedback
_RS	Remote SP

A.3. QUICK START CODE EXAMPLE:

SVP1/SPID/SPID/K/Z/A/S1A/1VH/2PV/2HV/3HC/3PV

This code configures the hardware specified on page A2 to be:

Loop1: Valve position control, Type K input, Ch1 VP output in slot 1, 4-20mA remote setpoint input.
Loop 2: PID control, RTD input in slot 3, 0-10Vdc Ch1 output in slot 4.
Loop 3: PID control, 4-20mA input in slot 6, Logic Ch1/Ch2 output in slot 5.

B. APPENDIX B SAFETY AND EMC INFORMATION .. 2

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B. Appendix B Safety and EMC Information

This controller is manufactured in the UK by Eurotherm Controls Ltd.

Please read this section carefully before installing the controller

This controller is intended for industrial temperature and process control applications when it will meet the requirements of the European Directives on Safety and EMC. Use in other applications, or failure to observe the installation instructions of this handbook may impair the safety or EMC protection provided by the controller. It is the responsibility of the installer to ensure the safety and EMC of any particular installation.

B.1. SAFETY

This controller complies with the European Low Voltage Directive 73/23/EEC, amended by 93/68/EEC, by the application of the safety standard EN 61010.

B.1.1. Electromagnetic compatibility

This controller conforms with the essential protection requirements of the EMC Directive 89/336/EEC, amended by 93/68/EEC, by the application of a Technical Construction File. This instrument satisfies the general requirements for heavy/light industrial and residential/commercial environments as described by EN 61326. For more information on product compliance refer to the Technical Construction File.

B.2. GENERAL

The information contained in this manual is subject to change without notice. While every effort has been made to ensure the accuracy of the information, your supplier shall not be held liable for errors contained herein.

Unpacking and storage

The packaging should contain an instrument mounted in its sleeve, two mounting brackets for panel installation and an Installation & Operating guide. Certain ranges are supplied with an input adapter.
If on receipt, the packaging or the instrument are damaged, do not install the product but contact your supplier. If the instrument is to be stored before use, protect from humidity and dust in an ambient temperature range of -30°C to +75°C.

B.3. SERVICE AND REPAIR

This controller has no user serviceable parts. Contact your supplier for repair.

Caution: Charged capacitors

Before removing an instrument from its sleeve, disconnect the supply and wait at least two minutes to allow capacitors to discharge. Failure to observe this precaution will expose capacitors that may be charged with hazardous voltages. In any case, avoid touching the exposed electronics of an instrument when withdrawing it from the sleeve.
Failure to observe these precautions may cause damage to components of the instrument or some discomfort to the user.

B.3.1. Electrostatic discharge precautions

When the controller is removed from its sleeve, some of the exposed electronic components are vulnerable to damage by electrostatic discharge from someone handling the controller. To avoid this, before handling the unplugged controller discharge yourself to ground.

B.3.2. Cleaning

Do not use water or water based products to clean labels or they will become illegible. Isopropyl alcohol may be used to clean labels. A mild soap solution may be used to clean other exterior surfaces of the product.

B.4. INSTALLATION SAFETY REQUIREMENTS

B.4.1. Safety Symbols

Various symbols are used on the instrument, they have the following meaning:

Caution, (refer to the accompanying documents)

Functional earth (ground) terminal

The functional earth connection is not required for safety purposes but to ground RFI filters.

This symbol indicates Information

B.4.2. Personnel

Installation must only be carried out by qualified personnel.

B.4.3. Enclosure of live parts

To prevent hands or metal tools touching parts that may be electrically live, the controller must be installed in an enclosure.

B.4.4. Isolation

The fixed digital I/O and analogue input are not isolated. The PV Input and all plug in modules are fully isolated. This is shown in Figure B-1.

The Analogue Input is a self biased differential input suitable for either grounded or floating transducers of low output impedance generating signal in the range of +/-10V or +/-20mA (with a burden resistor of 100 Ohms across + and - terminals).
This input is neither isolated from the instrument ground (which can be earthed via fixed I/O ports) nor isolated from the instrument earth terminal, therefore, under no circumstances should mains potentials be applied to any of its inputs.
In order for the Input to operate safely the common voltage at the inputs measured with respect to instrument ground should not exceed +/-120Vdc or ac_{rms}. For actively enhanced common mode rejection (i.e. operation within the spec.) this voltage should be limited to +/-40Vdc.
Floating transducers will automatically be biased to +2.5V with respect to instrument ground upon connection.

> Note: All the other I/Os are fully isolated from the instrument ground and each other.

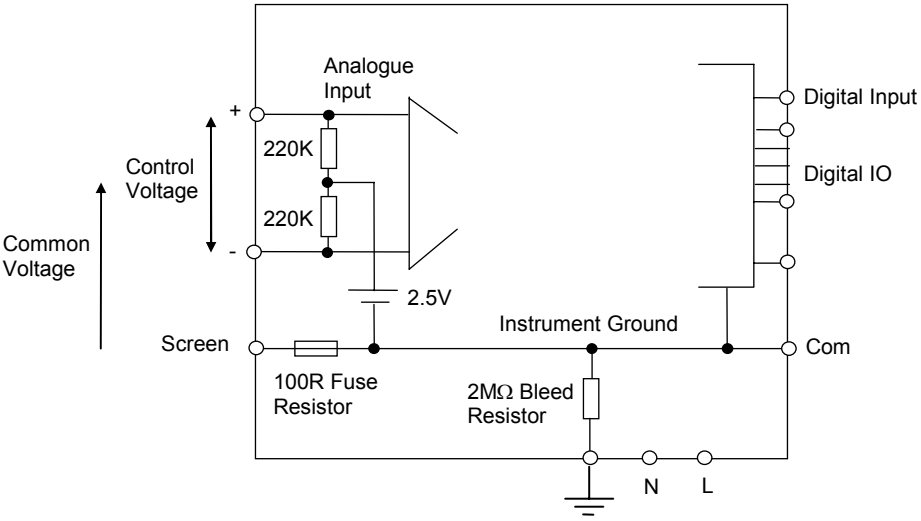

Figure B-1: Analogue Input and Fixed Digital I/O Equivalent Circuit

B.4.5. Wiring

It is important to connect the controller in accordance with the wiring data given in this handbook. Take particular care not to connect AC supplies to the low voltage sensor input or other low level inputs and outputs. Only use copper conductors for connections (except thermocouple inputs) and ensure that the wiring of installations comply with all local wiring regulations. For example in the in the UK use the latest version of the IEE wiring regulations, (BS7671). In the USA use NEC Class 1 wiring methods.

B.4.6. Power Isolation

The installation must include a power isolating switch or circuit breaker. This device should be in close proximity to the controller, within easy reach of the operator and marked as the disconnecting device for the instrument.

B.4.7. Earth leakage current

Due to RFI Filtering there is an earth leakage current of less than 0.5mA. This may affect the design of an installation of multiple controllers protected by Residual Current Device, (RCD) or Ground Fault Detector, (GFD) type circuit breakers.

B.4.8. Overcurrent protection

To protect the internal PCB tracking within the controller against excess currents, the AC power supply to the controller and power outputs must be wired through the fuse or circuit breaker specified in the technical specification.

B.4.9. Voltage rating

The maximum continuous voltage applied between any of the following terminals must not exceed 264Vac:

- line or neutral to any other connection;
- relay or triac output to logic, dc or sensor connections;
- any connection to ground.

The controller should not be wired to a three phase supply with an unearthed star connection. Under fault conditions such a supply could rise above 264Vac with respect to ground and the product would not be safe.

Voltage transients across the power supply connections, and between the power supply and ground, must not exceed 2.5kV. Where occasional voltage transients over 2.5kV are expected or measured, the power installation to both the instrument supply and load circuits should include a transient limiting device.

These units will typically include gas discharge tubes and metal oxide varistors that limit and control voltage transients on the supply line due to lightning strikes or inductive load switching. Devices are available in a range of energy ratings and should be selected to suit conditions at the installation.

B.4.10. Conductive pollution

Electrically conductive pollution must be excluded from the cabinet in which the controller is mounted. For example, carbon dust is a form of electrically conductive pollution. To secure a suitable atmosphere in conditions of conductive pollution, fit an air filter to the air intake of the cabinet. Where condensation is likely, for example at low temperatures, include a thermostatically controlled heater in the cabinet.

B.4.11. Over-temperature protection

When designing any control system it is essential to consider what will happen if any part of the system should fail. In temperature control applications the primary danger is that the heating will remain constantly on. Apart from spoiling the product, this could damage any process machinery being controlled, or even cause a fire.

Reasons why the heating might remain constantly on include:

- the temperature sensor becoming detached from the process;
- thermocouple wiring becoming short circuit;
- the controller failing with its heating output constantly on;
- an external valve or contactor sticking in the heating condition;
- the controller setpoint set too high.

Where damage or injury is possible, we recommend fitting a separate over-temperature protection unit, with an independent temperature sensor, which will isolate the heating circuit.

Please note that the alarm relays within the controller will not give protection under all failure conditions.

B.4.12. Grounding of the temperature sensor shield

In some installations it is common practice to replace the temperature sensor while the controller is still powered up. Under these conditions, as additional protection against electric shock, we recommend that the shield of the temperature sensor is grounded. Do not rely on grounding through the framework of the machine.

B.5. INSTALLATION REQUIREMENTS FOR EMC

To ensure compliance with the European EMC directive certain installation precautions are necessary as follows:

- For general guidance refer to EMC Installation Guide, HA025464.
- When using relay or triac outputs it may be necessary to fit a filter suitable for suppressing the emissions. The filter requirements will depend on the type of load. For typical applications we recommend Schaffner FN321 or FN612.

B.5.1. Routing of wires

To minimise the pick-up of electrical noise, the wiring for low voltage dc and particularly the sensor input should be routed away from high-current power cables. Where it is impractical to do this, use shielded cables with the shield grounded at both ends.

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C. Appendix C Technical Specification

All figures quoted at 0 to 50°C unless otherwise stated.

C.1. ALL ANALOGUE, DUAL AND PV INPUTS

Sample rate	9Hz (110msec.)
Input filtering	OFF to 999.9 seconds of filter time constant (f.t.c.). Default setting is 0.4 seconds unless stated otherwise
User calibration	Both the user calibration and a transducer scaling can be applied.
Sensor break	a.c. sensor break on each input (i.e. fast responding and no dc errors with high impedance sources).
Thermocouple types	Most linearisations including K,J,T,R,B,S,N,L,PII,C,D,E with linearisation error < ±0.2°C
General	Resolution (noise free) is quoted as a typical figure with f.t.c. set to the default value = 0.4 second. Resolution generally improves by a factor of two with every quadrupling of f.t.c. Calibration is quoted as offset error + percentage error of absolute reading at ambient temperature of 25°C Drift is quoted as extra offset and absolute reading errors per degree of ambient change from 25°C.

C.2. PRECISION PV INPUT / MODULE

Allocation	One standard and up to two additional PV input modules can be fitted in I/O slots 3 and 6
Isolation	Fully isolated from the rest of the instrument
mV input	Two ranges: ±40mV & ±80mV, used for thermocouple, linear mV source or 0 - 20mA with 2.49Ω Calibration: ±(1.5µV + 0.05% of reading), Resolution: 0.5µV for 40mV range & 1µV for 80mV range Drift: <±(0.05µV + 0.003% of absolute reading) per °C Input impedance: >100MΩ, Leakage: < 1nA
0 - 2V input	-1.4V to +2V, used for zirconia Calibration: ±(0.5mV + 0.05% of reading) Resolution: 60µV Drift: < ±(0.05mV + 0.003% of reading) per °C Input impedance: >100MΩ, Leakage: < 1nA
0 - 10V input	-3V to +10V, used for voltage input Calibration: ±(0.5mV + 0.1% of reading) Resolution: 180µV Drift: <±(0.1mV + 0.01% of reading) per °C Input impedance: 0.66MΩ
Pt100 input	0 to 400ohms (-200°C to +850°C), 3 matched wires - up to 22Ω in each lead without errors. Calibration: ±(0.1°C + 0.04% of reading in °C) Resolution: 0.02°C Drift: < ±(0.006°C + 0.002% of absolute reading in °C) per °C Bulb current: 0.2mA.
Thermocouple	Internal compensation: CJC rejection ratio >40:1 typical. CJ Temperature calibration error at 25^{O}C: <± 0.5°C 0°C, 45°C and 50°C external compensation available.
Zirconia probes	Most probes supported. Continuous monitoring of probe impedance (100Ω to 100KΩ)

C.3. DUAL (PROBE) INPUT MODULE

General	The same specification as for the Precision PV Input module applies with the exception of the following: Module offers two sensor/transmitter inputs, which share the same negative input terminal. One low level (mV, 0-20mA, thermocouple, Pt100) and one high level (0-2Vdc, 0-10Vdc) can be connected
Isolation	The two inputs are isolated from the rest of the instrument but not from each other
Sample rate	4.5Hz (220msec) - of each input
Input filtering	Default setting is 0.8 seconds

C.4. ANALOGUE INPUT

No of inputs	One fixed (Not isolated) Can be used with either floating or ground referenced transducers of low impedance – see Isolation.
Input range	-10V to +10V linear or 0 -20 mA with burden resistor of 100Ω. Calibration: ±(1.5mV + 0.1% of reading) Resolution: 0.9mV Drift: < ±(0.1mV + 0.006% of reading) per °C Input Impedance: 0.46MΩ (floating input), 0.23MΩ (ground referenced input)
Isolation	Not isolated from standard digital I/O . Differential type input with common mode range of ± 42Vdc (the average voltage of the two inputs with respect to 'Screen' or 'Common' terminals should be within ±42Vdc. CMRR : >110dB at 50/60Hz, >80dB at DC
Functions	Process variable, remote setpoint, power limit, feedforward, etc.

C.5. ANALOGUE INPUT MODULE

Allocation	Up to 4 analogue input modules can be fitted in I/O slots 1,3,4 & 6
Isolation	Fully isolated from the rest of the instrument
mV input	100mV range - used for thermocouple, linear mV source, or 0-20mA with 2.49Ω external burden resistor. Calibration: ± 10µV + 0.2% of reading Resolution: 6µV Drift: < ± 0.2µV + 0.004% of reading per ^{O}C Input impedance: >10MΩ, Leakage: <10nA
0 - 2Vdc input	-0.2V to +2.0V range - used for zirconia. Calibration: ± 2mV + 0.2% of reading Resolution: 30µV Drift: < ± 0.1mV + 0.004% of reading per ^{O}C Input impedance: >10MΩ, Leakage: <20nA
0 - 10Vdc input	-3V to +10.0V range - used for voltage input. Calibration: ± 2mV + 0.2% of reading

	Resolution: 200µV Drift: < ± 0.1mV + 0.02% of reading per ^{O}C Input impedance: >69KΩ
Pt100 input	0 to 400ohms (-200°C to +850°C), 3 matched wires - up to 22Ω in each lead without errors. Calibration: ±(0.4°C + 0.15% of reading in °C) Resolution: 0.08°C Drift: < ±(0.015°C + 0.005% of reading in °C) per °C Bulb current: 0.3mA.
Thermocouple	Internal compensation: CJC rejection ratio >25:1 typical. CJ Temperature calibration error at 25^{O}C: <± 2°C 0°C, 45°C and 50°C external compensation available.

C.6. STANDARD DIGITAL I/O

Allocation **not isolated**	1 digital input standard and 7 I/O which can be configured as inputs or outputs plus 1 changeover relay
Digital inputs	Voltage level : input active < 2Vdc, inactive >4Vdc Contact closure : input active <100ohms, inactive >28kohms
Digital outputs	Open collector, 24Vdc at 40mA drive capability, requires external supply
Changeover relay	Contact rating 2A at 264Vac resistive
Functions	Refer to Chapter 17
Operations	1,000,000 operations with addition of external snubber

C.7. DIGITAL INPUT MODULES

Module type	Triple contact input, Triple logic input - (isolated as a group)
Allocation	Can be fitted into slots 1, 3, 4, 5 or 6
Contact closure	Active <100ohms, inactive >28kohms
Logic inputs	Current sinking : active 10.8Vdc to 30Vdc at 2.5mA inactive -3 to 5Vdc at <-0.4mA
Functions	Refer to Chapter 18

C.8. DIGITAL OUTPUT MODULES

Module types	Single relay, dual relay, single triac, dual triac - (isolated as a group) (individually isolated) triple logic module - (isolated from instrument as a group)
Allocation	Can be fitted into slot 1, 3, 4, 5 or 6 (max. 3 triac modules per instrument)
Relay rating	2A, 264Vac resistive
Logic drive	12Vdc at 9mA
Triac rating	0.75A, 264Vac resistive
Functions	Refer to Chapter 18

C.9. ANALOGUE OUTPUT MODULES

Module types	1 channel DC control, 1 channel DC retransmission (5 max.)
Allocation	Can be fitted into slot 1, 3, 4, 5 or 6
Isolation	Fully isolated from the rest of the instrument
Range	0-20mA, 0-10Vdc
Resolution	1 part in 10,000 (2,000-noise free) 0.5% accurate for retransmission 1 part in 10,000 2.5% accurate for control
Functions	Refer to Chapter 18

C.10. TRANSMITTER PSU

Allocation	Can be fitted into slots 1, 3 ,4 ,5 or 6 - (isolated)
Transmitter	24Vdc at 20mA

C.11. TRANSDUCER PSU

Bridge voltage	Software selectable 5 or 10Vdc - (isolated)
Bridge resistance	300Ω to 15KΩ
Internal shunt resistor	30.1KΩ at 0.25%, used for calibration of 350Ω bridge

C.12. DUAL DC OUTPUT

Two Current Outputs	4-20mA, 20V output span (see section 21.3.13)
Isolation	Fully isolated from the instrument and each other
Accuracy	1%, 11 bit noise free resolution
Speed	50ms response
Can be configured as	20V min at full 22mA current load. 30V max at open circuit.
Transmitter/logic PSU	Short circuit protected at 22-24mA

C.13. HIGH RESOLUTION DC OUTPUT

Current Output	4-20mA, 20V output span (see section 21.3.14)
Accuracy	1%, 15 bit noise free resolution
Speed	40ms response
Transmitter/logic PSU	20V min at full 22mA current load. 30V max at open circuit. Short circuit protected at 21-28mA
Isolation	Fully isolated from the instrument and the PSU

C.14. POTENTIOMETER INPUT

Pot resistance	100Ω to 15KΩ, excitation of 0.5 volts - (isolated)

C.15. TDS MODULE

Meas. Frequency	1KHz
Conductivity range	40µS to 500 000µS (equivalent resistance 25 KΩ to 2Ω)
Max. cable length	100m
Isolation	Fully isolated from the rest of the instrument

C.16. 4-WIRE RTD INPUT

	PT100 Module	PT25 Module
Allocation	Can be fitted to I/O slots 3 and 6	
Isolation	Fully isolated from the rest of the instrument	
Sample rate	9Hz Typical	
Input filtering	OFF to 999.9 seconds of filter t.c. (default f.t.c.= 1.6 sesc.)	
Measured temperature range	-200 to +850°C with Pt100 linearization	-200 to +850°C with Pt25.5 linearization -200 to +50°C with Pt100 linearization when Pt25 module is used for reading Pt100 sensor.
Measured resistance range	0 - 440Ω	0 – 125Ω
Maximum resistance between A and D terminals	500Ω	135Ω
Bulb Current - from A to D	200µA	735µA
Calibration Accuracy @ 23 (±3) °C @ 50 (±15) %RH) /interpolate for other values/	±4mΩ @ 20Ω ±8mΩ @ 100Ω ±10mΩ @ 200Ω ±14mΩ @ 300Ω	±1mΩ @ 5Ω ±2mΩ @ 25.5Ω ±2.5mΩ @ 50Ω ±3.5mΩ @ 76Ω
Ambient temperature drift (within 15°C and 35°C)	± (5ppm of reading +0.25mΩ) /°C	± (5ppm of reading +0.07mΩ) /°C
Long term drift @ 15°C to 35°C @ 50 (±20) %RH	± (70ppm of reading + 25ppm of Span)/year	
Resolution with: f.t.c. = OFF f.c.t. = 1.6 secs. f.t.c. = 10 secs.	/Resolution as peak deviation from mean value/ ± 6mΩ (±16mK) ± 1.5mΩ (±4mK) ± 0.8mΩ (±2mK)	 ±1.5mΩ (±16mK, ±4mK*) ±0.4mΩ (±4mK, ±1mK*) ±0.2mΩ (±2mK, ±0.5mK*)
Linearity /within 0 to 80% of F.Span/	±2mΩ Typ.	±0.6mΩ Typ.
linearization /Pt100 and Pt25.5/	±5mK - maximum deviation within –200°C to 850°C from the standard characteristic that assumes precise 100.000Ω and 25.500Ω PRT resistances at 0°C.	
Other Features	a.c. sensor break detection. User Calibration.	
Immunity to EM field interference (EN61326 Industrial levels)	Maximum deviation on measured values during the tests is within ±0.005% of Full Span.	

For description and remedies of other possible sources of error see sections 25.6.6.1. & 25.6.6.3.

C.17. DIGITAL COMMUNICATIONS

Allocation	2 modules fitted in slots H & J (isolated)
Modbus	RS232, 2 wire or 4 wire RS485, max baud 19.2KB in H module & 9.6KB in J module
Profibus-DP	High speed, RS485, 1.5Mbaud. H slot ony
DeviceNet/ EtherNet	H slot only

C.18. ALARMS

No of Alarms	Input alarms (2), loop alarms (2) User alarms (8)
Alarm types	Full scale, deviation, rate of change, sensor break plus application specific
Modes	Latching or non-latching, blocking, time delay
Parameters	Refer to Chapter 7

C.19. USER MESSAGES

No of messages	Maximum 100, triggered by operator or alarm or used for custom parameter names
Format	Up to 16 characters

C.20. CONTROL FUNCTIONS

No of loops	One, two or three
Modes	On/off, PID, motorised valve with or without feedback
Options	Cascade, ratio, override or feed forward
Cooling algorithms	Linear, water, oil or fan
PID sets	3 per loop (Cascade loop includes master and slave parameters)
Manual mode	Bumpless transfer or forced manual output, manual tracking available
Setpoint rate limit	Display units per second, minute or hour

C.21. SETPOINT PROGRAMMER

Programmer modes	Synchronous or asynchronous
Programmer types	Time to Target or Ramp Rate
No of programs	A maximum of 60 programs assignable over 600 segments for a time to target programmer and 480 segments for a ramp rate programmer. A program can consist of up to 3 variables. Programs can be given user defined 16 character names
Event outputs	Up to 16, can be assigned individually to segments or called as part of an event group

C.22. ADVANCED FUNCTIONS

Application blocks	32 digital operations 32 patch wiring operators 32 analogue calculations 3 multiple operators
Timers	4, On Pulse, Off delay, one shot and min-On
Totalisers	4, trigger level & reset input
Real time clock	Day of week and time
Pattern generators	16 x 16, 2 off

C.23. GENERAL SPECIFICATION

Display range	5 digits including up to 3 decimal places
Supply	85-264Vac, 20Watts (max)
Operating ambient	0 - 50°C and 5 to 95% RH non condensing
Storage temp	-10 to +70°C
Panel sealing	IP65
Dimensions	96H x 96W x 150D (mm)
EMC standards	EN61326 electrical equipment for measurement, control and laboratory use EMS requirements - suitable for, commercial and light industrial as well as heavy industrial environments With Ethernet or Devicenet module fitted product is suitable for heavy industrial environments only (class A emissions).
Safety standards	Meets EN61010 installation category II, pollution degree 2
Atmospheres	Not suitable for use above 2000m or in explosive or corrosive atmospheres
Inrush Current	High Voltage controller – 30A duration 100µs Low Voltage controller – 15A duration 100µs

C.24. GRAPHICAL REPRESENTATION OF ERRORS

This section shows graphically the effects of adding all contributions of different errors for each input type and range. The errors are a combination of:
Calibration accuracy, Drift with ambient temperature, Linearity error, Leakage

C.24.1. mV Input

Two ranges:

working range	±40mV		
full linear range	±60mV		
noise (resolution)	1uV - OFF,	0.5uV - 0.4sec,	0.25uV - 1.6sec
working range	±80mV		
full linear range	±105mV		
noise (resolution)	2uV - OFF,	1uV - 0.4sec,	0.5uV - 1.6sec

Calibration accuracy @ 25°C
< ± (1.5uV + 0.05% of |reading|)

Drift with ambient temperature
< ±(0.05uV + 0.003% of |reading|) per °C

Linearity error
< ±0.002% of span (i.e. <1uV, <2uV)

Leakage
< ±1nA (typically ±200pA)

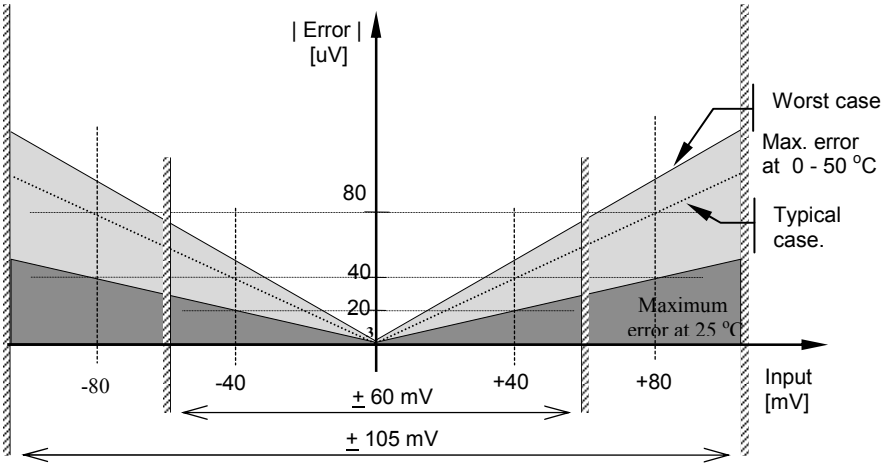

Figure C-1: Error Graph - mV Input

C.24.2. Mid range high impedance Input

0 - 2V Input type

Range:
working range -1.4V to +2V
full linear range -1.8V to +2.4V
noise (resolution) 100uV - OFF, 50uV - 0.4sec, 35uV - 1.6sec

Calibration accuracy @ 25°C
< ± (0.5mV + 0.05% of |reading|)

Drift with ambient temperature
< ±(0.05mV + 0.003% of |reading|) per °C

Linearity error
< ± 0.01% of span (i.e. ± 200uV)

Input Impedance & Leakage
>100MΩ < 1nA

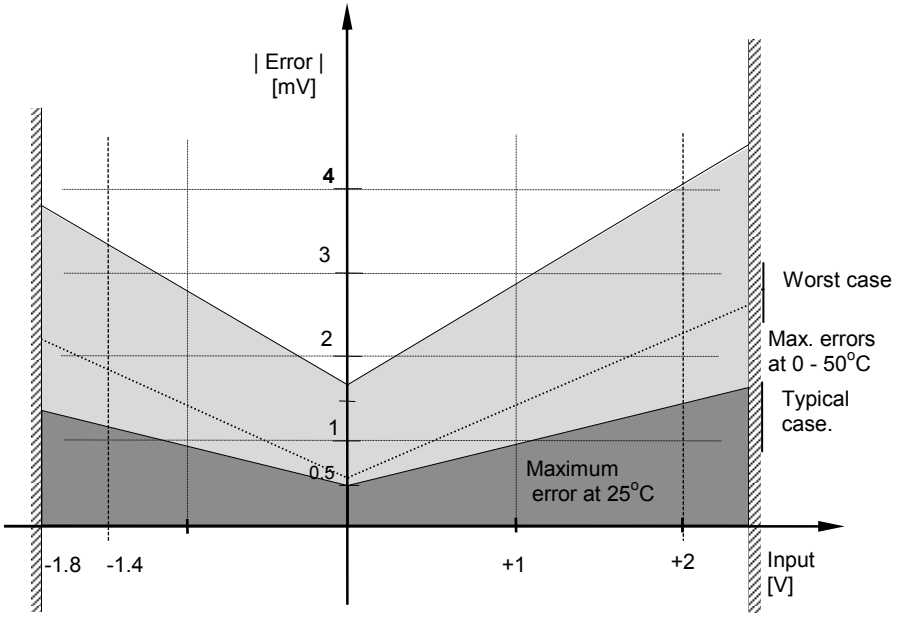

Figure C-2: Error Graph - 0 - 2V Input

C.24.3. High Level Input

0 - 10V Input type

Range:

working range -3V to +10V
full linear range - 5V to +14V
noise (resolution) 300uV - OFF, 150uV - 0.4sec, 100uV - 1.6sec

Calibration accuracy @ 25^{O}C
< ± (0.5mV + 0.1% of |reading|)

Drift with ambient temperature
< ±(0.01mV + 0.006% of |reading|) per ^{o}C

Linearity error
< ±0.02% of span (i.e. ± 2mV)

Input Impedance
0.66 MΩ

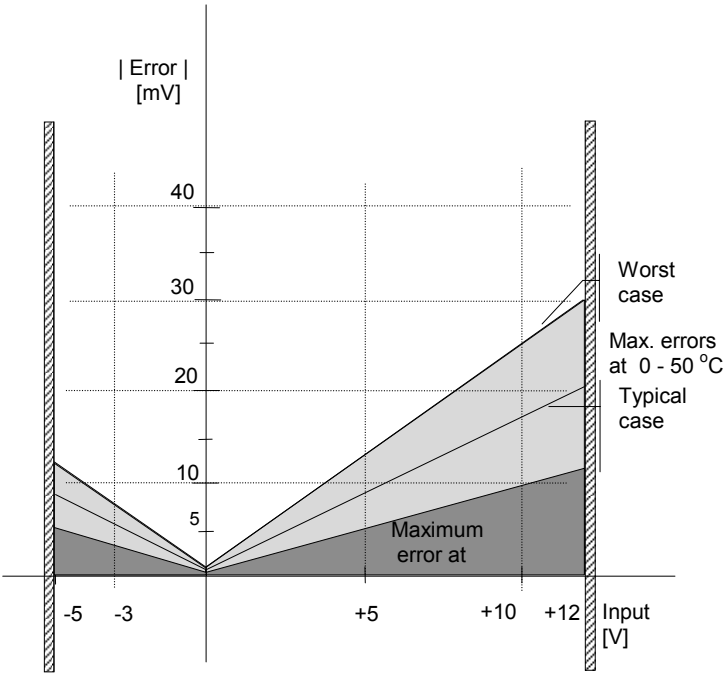

Figure C-3: Error Graph - 0 - 10V Input

C.24.4. 3-Wire RTD (Pt-100) Input type

Resistance measurement specification in Ohms:
Range

0 to 400Ω with up to 22Ωin each connecting lead

Noise (resolution)

8mΩ - 0.4sec, 4mΩ - 1.6sec

Calibration accuracy limits @ 25^{O}C

< ± (35mΩ @110Ω + 0.03% of |reading - 110Ω|)

Drift with ambient temperature

± (0.002% of |reading|) per ^{o}C

Linearity error

< ±15 mΩ

Pt-100 measurement specification in ^{o}C:

Range

-200 ^{o}C to +850 ^{o}C

Noise (resolution)

0.02 ^{o}C - 0.4sec, 0.01 ^{o}C - 1.6sec

Calibration accuracy limit @ 25^{O}C

< ± (0.1 ^{o}C + 0.03% of |reading in ^{o}C |)

Drift with ambient temperature

< ±(0.0055 ^{o}C + 0.002% of |reading in ^{o}C |) per ^{o}C of ambient change

Linearity + Linearisation error

< ± 55 ^{o}mC (i.e. 50 ^{o}mC + 5 ^{o}mC)

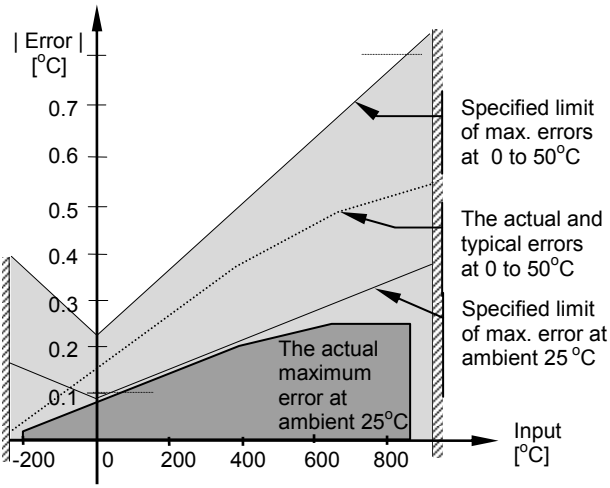

Figure C-4: Error Graph - RTD Input

C.24.5. Thermocouple Input type

Internal CJT sensing spec
Calibration error @ 25 °C (including temp. difference between top and bottom screws)
< ± 0.5 °C

Total CJT error
< ± (0.5 °C + 0.012 °C per 1 °C of ambient change)
(i.e. CJC Rejection for measured temperatures above 0 °C is > 80 : 1)

Noise (resolution)
0.01 °C

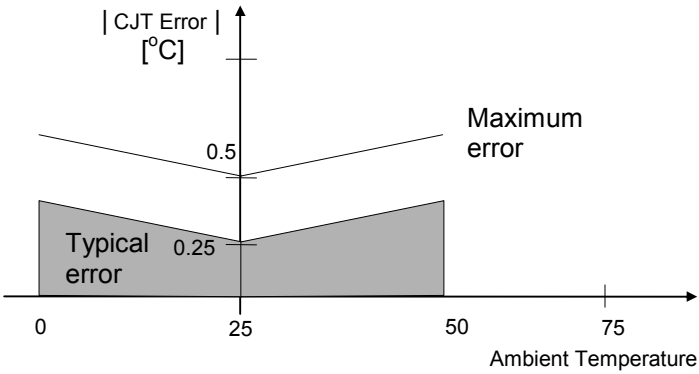

Figure C-5: Overall CJT Error at Different Ambient Temperatures

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